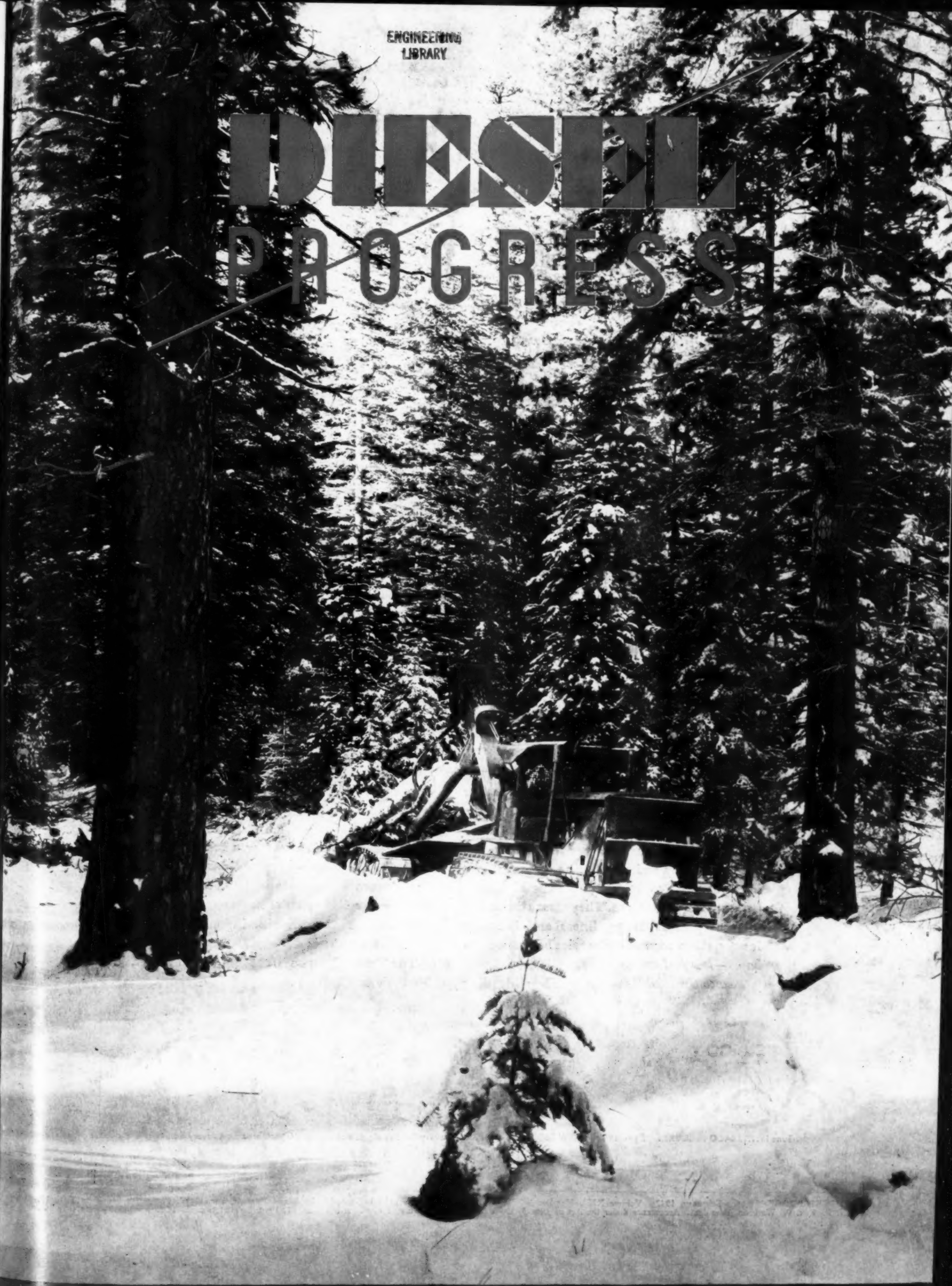
DIESEL PROGRESS



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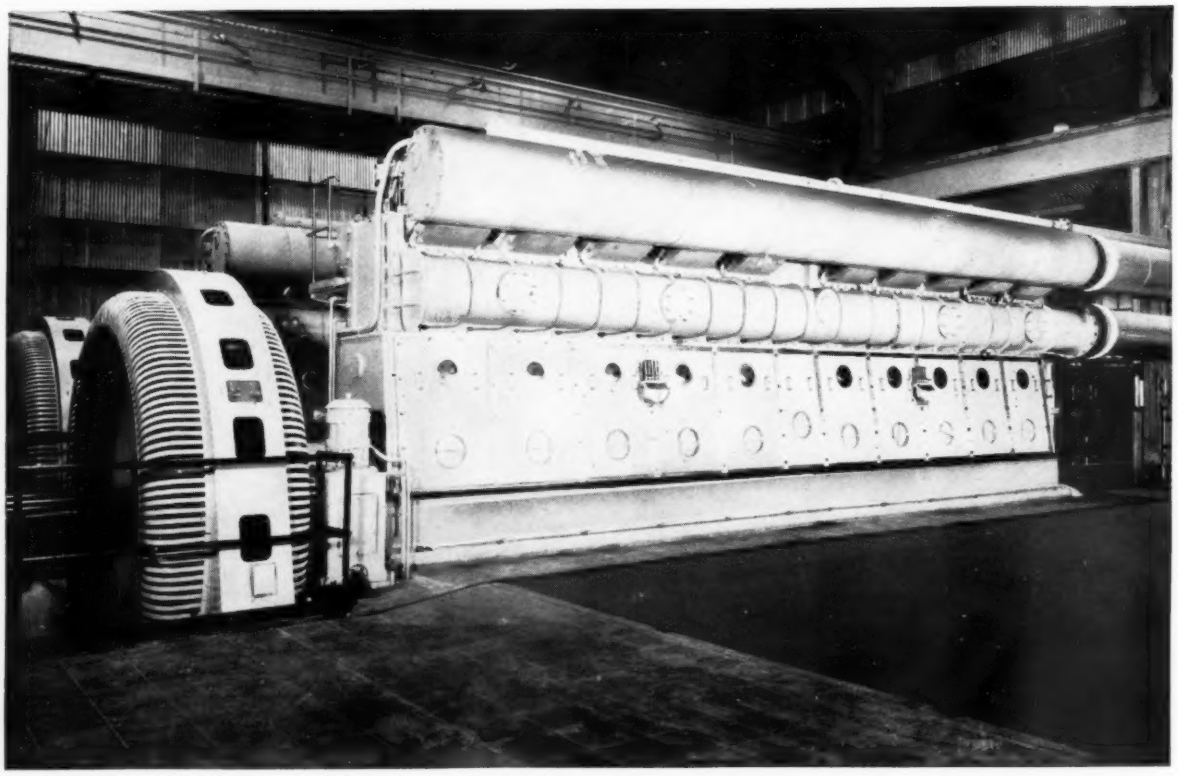

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DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

Front Cover Illustration: Winter Logging Ponderoso Pine with Caterpillar Diesel tractor hauling a quarter million board feet per day in two feet of snow at 4500 ft. elevation near Chester, California. Another Caterpillar tractor with bulldozer keeps landings and skid roads clear of snow.

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D. E. M. A. ANNUAL MEETING HIGHLIGHTED BY "BOSS KET'S" TALK

THE Diesel Engine Manufacturers Association held its annual meeting in Chicago, December 11 last and was treated to one of Charles F. Kettering's inimitable man-to-man talks as the high spot of the meeting. It was through the good offices of George Codrington, General Motors Vice President, that "Boss Ket" was secured for this occasion and faced by top officials of the D.E.M.A. member companies, "Ket" spoke as one of the family on "What Is Our Competition." He feels that one of our chief competitions is the ignorance of the general public in general and of the rising generation in particular as to what Diesel engines are and our urgent need of some "straight-forward" textbooks. "Ket" pointed out that high-compression gasoline engines and gas turbines are possible competitors, but he emphasized that if the Diesel industry keeps its feet on the ground and fully exploits its accomplishments with an eye always to the future, it has little to worry about. It was an inspiring talk—enthusiastically received.

Among actions taken by the meeting was a resolution to produce a new edition of Marine Diesel Engine Standards, to be out in October 1947, and to slant the book toward more usefulness to naval architects and shipbuilders and the marine field is general.

A committee was appointed to work with insurance companies in an effort to improve Diesel inspection service working toward decreasing losses and reducing insurance rates. The association will also lodge a protest with the State Department against existing tariff rates.

March 20 was tentatively set for a marine conference for the naval architects, shipbuilders and operators of the Gulf region, similar to the meeting held in San Francisco last October. The Gulf meeting will be held in New Orleans.

President E. J. Schwanhausser was authorized to call a two-day meeting of members' advertising and public relations executives to formulate public relations programs.

E. J. Schwanhausser, Vice President of Worthington Pump & Machinery Corp., was re-elected to the Presidency of the Diesel Engine Manufacturers Association at the Association's Annual Meeting held December 11, in Chicago, Illinois.

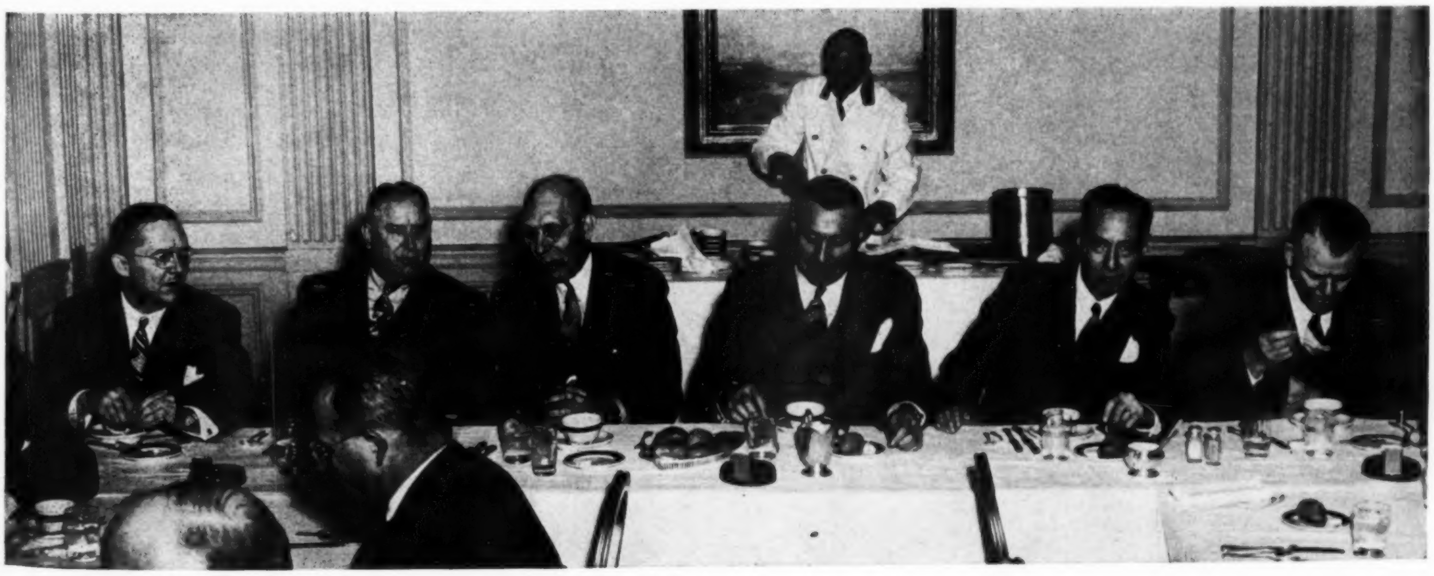
Re-elected as Vice Presidents of D.E.M.A. were Gordon Lefebvre, President of Cooper-Bessemer Corporation and J. E. Peterson, Vice President of General Machinery Corp., Robert H. Morse, Jr., Vice President and General Sales Manager of Fairbanks, Morse & Company, was returned to the Office of Treasurer.

Directors were elected as follows: G. F. Twist, Vice President and General Manager, Atlas Imperial Diesel Engine Co., William E. Corrigan, Vice President of American Locomotive Company, Norris H. Schwenk, President of Busch-Sulzer Bros.-Diesel Engine Co., George W. Codrington, Vice President of General Motors Corporation and General Manager, Cleveland Diesel Engine Division, A. W. McKinney, Vice President and General Manager of Sales, National Supply Company and Robert E. Friend, President of Nordberg.

Highlighting the program of the Annual Meeting were an address by Charles F. Kettering, General Manager, Research Division, General Motors Corporation and a discussion of Diesel engine fuel oils led by Mr. Morse.

Twenty-six engineers, representing member companies of the Diesel Engine Manufacturers Association, met for two days on December 10 and 11 discussing topics of mutual interest. Presiding over their sessions were Mr. Schwanhausser and L. B. Jackson, Executive Director of Engineering, Diesel Division, American Locomotive Company.

Speakers' table, left to right: Robert H. Morse, Jr., V.P. Fairbanks, Morse & Co.; George W. Codrington, V.P. General Motors and Gen. Mgr. Cleveland Diesel Div.; Charles F. Kettering, V.P. & Gen. Mgr., Research Div., General Motors Corp.; E. J. Schwanhausser, V.P. Worthington Pump & Machinery Corp.; Robert E. Friend, Pres. Nordberg Manufacturing Co.; Gordon Lefebvre, Pres. Cooper-Bessemer Corporation.



ANOTHER BIG WESTERN COAL RAILROAD GOES DIESEL

By CHARLES F. A. MANN

ALONG the strip of border states between the Great Lakes and the North Pacific Coast, runs one of America's most picturesque railroads, the Northern Pacific Railway, linking St. Paul-Minneapolis-Duluth with Puget Sound and Columbia River ports. Like a shy, worried, conservative old heiress, this great Land Grant System has been alternately fat with surplus cash and "temporal prosperity" and practically busted for years at a stretch because of the generally flattened purses of all her huge family of loving relations woven through the economic and political fabric of an area twice as large as Western Europe not to mention outlandish tax burdens from every direction. Thousands of little enterprises, farms, mines, factories and communities grew up with the Grand Old Lady, from way back in 1864 when Congress proposed a Northern Transcontinental railway. In good times these pioneering associates are a twice-blessed blessing; in depression, they form one of the most exasperating economic patterns in which a great corporation has to operate. The Northern Pacific has stirred the halls of Congress; ahs stirred the courts of the Atlantic Seaboard and far west and has upset and re-made several times huge plans in the financial marts of the whole world. It is, therefore, no wonder that its respectable old age finds the whole organization a shy, quiet, ultra conservative, tight-lipped group, with its eyes fixed not on the lush prosperity of the moment, but the lean years when its empire again faces tough sledding.

And all its loving cousins and friends come running home to grandma and beg her to forgive this year's interest on a land contract; last year's, this year's and next year's grazing rentals; a few years mine lease payments and perhaps "easy credit" on a lot of sadly delinquent demurrage, switching and freight charges, or perhaps a few thousand dollars overdue payments on timber sale contracts or wharf rentals. What is the company to do? Get tough and chase all these poor devils away from its doorstep, or "fernigglе" and "fernaggle" to cooperate in keeping them all going? Inevitably it does the latter. It has often been said that the Northern Pacific's Legal and Land Departments have saved five states from going bankrupt by its rare stewardship in economic matters, about which there is no written "directive," "law" or "regulation." The dear old N.P. just plods along and keeps its mouth shut.

The fabulous Northern Pacific Land Grant, which covered a lot of square miles but was worthless before the railroad came, contained practically everything necessary to rear and produce—civilization, from buckwheat, sheep, coal, oil, ore, rock and on up to tall timber and hydroelectric power, not to mention townsites and port sites. Sixty years ago America knew of but one fuel for developing industrial and transportation power—COAL. Northern Pacific's vast coal lands yielded bituminous coal by the endless trainload. It was there for the taking, to run the railroad, heat towns and power industry all through the border states.

In the Rockies east of Missoula, Montana, big Northern Pacific Diesel drags a mile of freight up long grade.

Its fabulous timberlands gave birth to companies which have produced 35% of all the timber harvested and manufactured in the whole U.S.A. from 1750 to 1946! Yet ironically, the cash income from timber sales at no time was big enough to even pay a $1.00 dividend in a given year on its stock! The idea was to make this timber the juice of the economic life of five states, and produce simple transportation revenue! Is this greedy capitalism or stewardship over an empire?

Like all pioneers, the Northern Pacific got pushed around and badly bruised. Poverty and competition finally got it under the fabulous wing of James J. Hill and friends, to be used as collateral in saving the slim-pursed Great Northern and acquiring the Burlington System, to become an integral part of the world's greatest and wealthiest private enterprise unit—the Northern Pacific-Great Northern-Burlington Railroad Empire.

So, the evolution of motive power and operations on the Northern Pacific since shortly after 1900 stayed geared to the use of coal fired steam and building up the rich empire along its "Main Street of the Northwest." The hard-bitten officers naturally were tough meat for glib tongued salesmen. It never fell for a line of nice talk. It loyally supported its great family of home town suppliers, including its coal mines.

The advent of the Diesel railroading era ten years ago found the Northern Pacific equipped with a fleet of magnificent steam power. Hundreds of Mikados of assorted vintages; the wondrous 4-6-2 and 4-8-4 passenger engines; three types of articulated or mallet engines—the lighter, 1913 compounds for the West End mountains and heavy curves; the modern 4-6-6-4 high speed simple articulateds and 12 of the fabulous Class Z-5 simple articulateds, known throughout the world as the Yellowstone types, the most efficient large-size super locomotive ever built, to run between Mandan, No. Dakota and Glendive, Montana. These engines, built in 1930, have fireboxes as big as an ordinary bedroom, to burn semi-bituminous coal from the N.P.'s own Coalstrip, Montana, strip mines. It was, therefore, natural that the Northern Pacific would sit calmly by and let the Diesel pioneering era become somebody else's baby. Why junk the fleet of splendid steam just yet? Yet it was among the first Western systems to dip lightly into Diesel switchers, despite its enormous inventory of steam switchers. It egged on Diesel manufacturers to hurry up and get out of their swaddling clothes and produce something out of this world, and, by merely being patient, was prepared to seize the economic advantages of Diesel the minute Diesel had proved it was ready.

That's the way the N.P. always operates. It got itself battle-scarred, bruised, bent and twisted too often as a pioneer, to face the Diesel era without a catchers mask and the arnica bottle of patience handy on the shelf. Pioneering enterprises, like pioneering humans, always get nearly **pounded to pieces.**

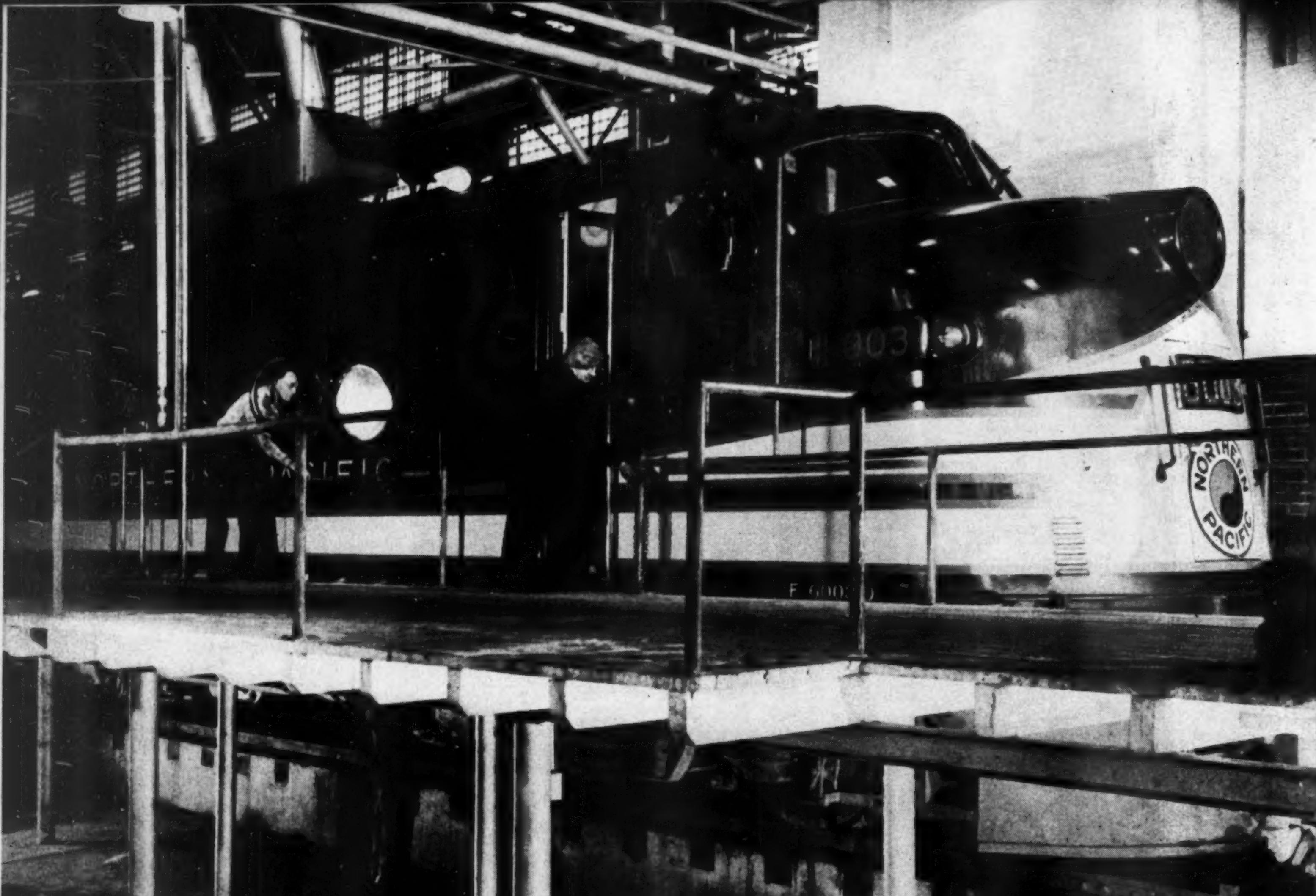
So, the railroad world woke up with a jerk in 1944 when the N.P.'s wartime load suddenly produced a set of cold statistics to prove that at least two mainline segments of the system were ready for Diesel freight power. They received eleven 5400 hp. 4 unit EMD freight Diesels from February 1944 to January 1945, quietly, with 2 assigned to the 1st and 2nd Districts of the Yellowstone Division, between Glendive, Mont. and Mandan, N.D., 215.7 miles; and 9 on the First District of Tacoma Division, between Auburn and Yakima, Wash., 139.6 miles.

What happened since made U. S. Diesel records. The cagey line concentrated its statistical fire on showing how close the comparison between low-cost, efficient steam and modern Diesel could become on the Yellowstone Division; and how far apart were the economies of modern Diesel with outmoded steam. The result has been unique and of national importance.

The Northern Pacific Line between Yakima and Auburn, Wash., is peculiar in that it only handles about 40% (normally) of the tonnage that is handled East of Yakima's rich fruit belt, and a few miles further east at Pasco, where the Portland feeder comes into the main line.

Therefore heavy outlay for modern bridges, steel and big tunnels has been concentrated for many years between Yakima-Pasco and St. Paul, rather than on to the Coast. So, the lighter power and easier schedules were the rule in this twisting river-canyon, mountain line. The

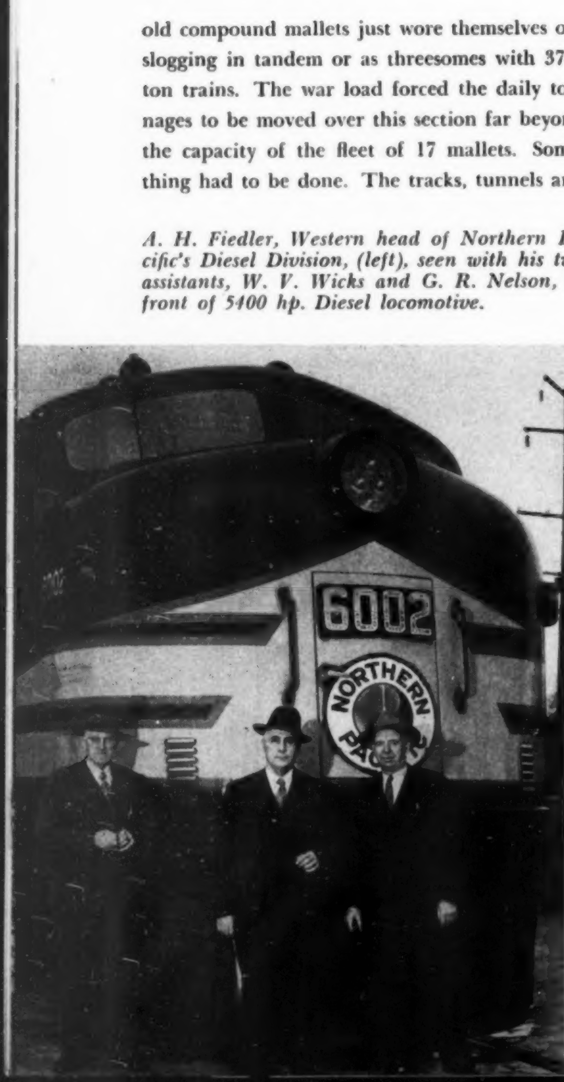
Map showing Northern Pacific Railroad System in its sweep from Chicago to Pacific Coast.



One of the big EMD Diesels at Auburn, Washington, shop. This $500,000 shop handles Diesel repairs for Puget Sound area.

old compound mallets just wore themselves out slogging in tandem or as threesomes with 3700 ton trains. The war load forced the daily tonnages to be moved over this section far beyond the capacity of the fleet of 17 mallets. Something had to be done. The tracks, tunnels and

A. H. Fiedler, Western head of Northern Pacific's Diesel Division, (left), seen with his two assistants, W. V. Wicks and G. R. Nelson, in front of 5400 hp. Diesel locomotive.



bridges weren't big enough to run the high-speed 4-6-6-4 simple articulateds west of Yakima. No time or manpower to enlarge the 2-mile Stampede Tunnel or dozens of bridges and shorter tunnels. The thing was to buy motive power that could use existing tracks, bridges and tunnels without spending a cent on enlarging the plant.

So Diesels were the only answer. They slid around the endless curves in Yakima Canyon and up and down Stampede Pass and in Green River Canyon easily, swiftly and with bigger loads. Substituting for the 2 mallet helpers that used to assist the 3,700 ton freights up the 12 miles of 2.2% West slope grade and the 10 miles of East slope grade, mostly 2.2%, 5400 hp., these EMD Diesels were highly successful.

Two 5400 Diesels move 4500 tons over the Cascade Mountain crossing, faster and with no fuss in braking downhill, and can operate 24 hours round the clock, which steam won't do.

The substitution of a 2-Diesel move for the 3-steamer move, in this territory, increased the gross ton miles per train hour from an average of 33,472 to 45,726 in the first 11 months, or a gain of 36.6%! Even if it cost more to run Diesels than steam, here, it would still be economical to run the line with modern Diesels.

Stampede Tunnel, piercing the Cascade Summit at just over 2800 ft. altitude, was built in 1888. Surprisingly, most of it is in excellent condition, but in 1888 they built tunnels of rather small bore to handle small power and cars. In 1946 the rolling stock had outgrown the tunnel. The Z Class engines on heavy freights, nearly touch the sidewalls and roof; thesmoke and heat nearly kills off the crew, so cool, small-bore, easy-on-track Diesels here saved the N.P. a new $12,000,000 Cascade Tunnel. The cost of the tunnel alone would equal 20 new 6,000 hp. Diesel freight locomotives!

A Ride Over the Cascades on the New Diesels

This Travel-Interlude is the best way of visualizing the operating problems of the Northern Pacific's famed Cascade mountain crossing. It is a rainy night in Auburn transfer yard. Strings of freight cars from up and down the Puget Sound country from as far North as Bellingham

and as far South as Willapa Harbor, plus the Seattle-Tacoma-Everett metropolitan area, come in and are shuffled and made up into transcontinental freight trains. Normally the movement is West to East. In wartime it reversed itself. Our train is a good example of a fast, eastern destination train, with assorted setouts and pickups scheduled between Auburn and Yakima. Our train is a "J Manifest" and has 111 cars and about 4500 tons. Many empties are being rushed East for more freight that used to come via the Panama Canal in intercoastal steamers. Harry Werner is conductor and R. H. Johnston is engineer. We slog along up the 43 mile to Lester at 10 to 16 miles per hour, leaving Auburn Yard at 1:35 A.M. At no time in the next four hours, do we ever see the caboose, on account of curvature and a bit over 6,000 ft. of train strung out behind us.

At Lester, a brief stop, where, if necessary, refueling and re-sanding can be done. Another 5400 hp. Diesel is cut in at Lester, for the 12 mile climb up the 2.2% grade to Stampede tunnel, in the gray dawn, with rails wet and a foggy mist greasing everything. An old compound is rated at 1250 tons from Lester to the tunnel, while our Diesel is rated at 2250, or 1,000 tons or 90% larger capacity. We speed through the Stampede tunnel, with no gas or heat, so anything trailing behind us can immediately enter the tunnel without waiting for the blowers to clear away the smoke. Some 2 hours of delays are met with in waiting for the morning Westbound fleet of five passenger trains to clear and we finally drop down to Easton to set out a few cars and pick up Roslyn coal, mind you—coal from N.P. mines riding a Diesel! Then on to Cle Elum on the mile long passing track, and a jump-skip across to a hamburger stand for ham and eggs. Then on to Ellensburg, with another set-out and pickup.

Down the smooth, snake-like, steeply banked Yakima Canyon in bright hot sun, with sun-visors down and all windows open—its desert here, barely 75 miles from the green, wet jungles of the Cascades. We use the electric brake occasionally, and once out of the canyon, rolling down the valley at 55 mile clip, and despite the delays, we roll into Yakima Yard at 1:20 P.M., from 5 to 12 hours faster time, with 40% bigger train, than with the old steam operation!

Naturally the coal docks and watering facilities on this section of track are old, small and inadequate. The Northern Pacific expects to save its stockholders about $1,000,000 in cost of replacing them all for steam operation. Once this section is all-Diesel, they won't need tunnel blowers, water towers, coal docks or anything else. And when Roslyn Mines are operating, they haul coal with Diesel cheaper than with steam if they furnished the locomotive fuel "for free." And when John L. Lewis shuts down Roslyn Mine, nobody will care, because nobody wants to see coal fired steam back again on this section of the Northern Pacific. The best salesman for Diesel is John L. Lewis, as the Wall St. Journal says.

This 139 mile stretch of track in steam operation, uses 17 compound mallets for 30% smaller daily load than 11 Diesels will carry! Water stops are required with steam at Kanasket, Lester, Easton and Ellensburg. With Diesel, fuel, lube, sand and water enough to make the entire round trip from Yakima to Auburn without a single stop! Sometimes a steam freight loses half an hour stopping for coal and water for the two helpers alone, at Easton and Ellensburg! Not one second lost with Diesel.

Normally 3 Diesel manifests are operated each way daily over the Cascades with Diesel. If business permits, they may go through to Pasco or Spokane. Despite mileage lost in slow helper moves in the mountains with the 5400's, the fleet of Diesels averages over 300 miles per day. Two road foremen of engines are regularly assigned to instruct crews between Auburn and Yakima.

Our train happened to be going right on to Chicago. Diesel No. 6002 was changed out and Diesel No. 6004 was substituted, leaving Yakima with 117 cars—this time loads predominating.

We had 104 loads and but 13 empties, a train of 6270 tons. The ride down to the Columbia River at Pasco was amazing for its speed and simplicity. One short hill in the lower Valley slowed us to 13 mph., but otherwise it was from 45 to 60 mph. with this huge freight, all the way. This 90 mile stretch of fast freighting with Diesel, including the hill, slowdowns for small towns, passing Westbound trains and the long grind over the Columbia River bridge at Pasco, took exactly 4 hours. It was 8:30 when we rode into the yard. Road time for the 90 miles was actually less than 2 hours the rest in operating delays. The Columbia River bridge, light for 1946, but heavy when it was built, would cost $7,000,000 to rebuild for heavy steam. Again the Northern Pacific saves $7,000,000 outlay by substituting Diesels. This whole Pasco-Auburn Diesel operation is so unique and so glaringly a sound economic proposition that it is one of the spots in the U.S.A. to watch Diesel locomotives evolve the railroad of tomorrow.

G. L. Ernstrom, Northern Pacific superintendent of motive power, (left), and Willard Simpson, superintendent of Diesel engines, check Diesel piston rings.

The Yellowstone Division operation is so obviously statistical that a mere citing of the record will give the picture. Steam locomotives will haul west of Glendive twice the tonnage they can haul between Glendive and Mandan. So it gave birth to the giant Z-5 Yellowstone steamers.

A year's comparison between steam and Diesel on the 1st District of Yellowstone Division, showed Eastbound, that Diesel would average a train of 5057 tons while steam would average 4768 tons, a 6% advantage for Diesel. But, they'd do it 18% faster, in tons per train hour.

Westbound Diesel would haul 3586 tons and steam 2886 an increase of 24.3% in tonnage, and 52% faster in tons per train hour.

On the 2nd Yellowstone District, comparisons were even more glaring. The tons per train with Diesel Eastbound, were 4657 as against 4059 with steam, 14.7% increase. Tons per hour were 43% greater. Westbound, 3487 tons with Diesel and only 2451 with steam, an increase of 42.3%. But 63.8% increase in tons per train hour with Diesel over steam!

So Rosebud Coal, from the huge Coalstrip Mines will, even if it is "for free," not move tonnage so cheaply, or in such quantities or so fast, as modern Diesel. So, the N.P. "Goes Diesel" right in the heart of the world's most plentiful supply of the cheapest locomotive coal on the Continent where huge electric shovels mine it from the surface like gravel.

Records kept on the Tacoma Division indicate that these Diesels, despite limitations in operating practice, track capacity, mountain grades and helper Diesels being merely withdrawn road Diesels, which dilute the statistics, do about 5,000 miles per month; they are utilized about 62% of the time; average 95% availability in hours per month; and cost from 68 to 84 cents per locomotive mile for all operating costs except crews wages. No maintainers are carried and costs are figured liberally for contingencies and proper allocation of shop costs and materials. They are averaging about 18 million gross ton miles per month. Fuel is about the same national average cost that Diesel fuel is figured everywhere, about 6 cents per gallon on the locomotive.

Later, perhaps, when all units of the Diesel fleet have a good period of rhythm of road service and general shopping, perhaps we can publish more comprehensive statistics when the Northern Pacific has several million miles of efficient operation behind them. But you can be sure it will be the same canny, efficient Diesel operation that they have already shown to date, the kind that brings operating ratios down and down, even in adverse times.

The railroad world and the public were thrilled late in 1946 to learn that the Northern Pacific's new streamlined version of the North Coast Limited, de-luxe coach-room train between Chicago and the North Coast, will be a 100% Diesel operation. Six three-unit 4500 hp. F.3 type General Motors EMD Diesels have been purchased for this service, with heating boilers, high speed gearing and all the trimmings. In addition to the thirteen 4500 hp. EMD freight Diesels now in service on the N.P., there are on order five 6000 F.3 EMD Diesels with 4 units, for additional freight usage. This fleet of 24 big Diesel road engines, plus 55 Diesel switchers scattered throughout the system gives the N.P. a pretty good start toward Dieselization despite its historic position as the No. 1 Northwest coal railroad.

On the Yellowstone Division, Diesel maintenance and repairs are handled at the Glendive, Montana, shop. However, on the West end, with switching gradually converting to Diesel, and main line power being Dieselized, plus the prospect of Dieselization of transcontinental passenger service, the logical thing was to start fresh and not try to modify any of the company's extensive facilities in Seattle, Tacoma and Auburn. The Diesel shop at Auburn was designed to handle work on all road and switcher Diesels in the whole Puget Sound area.

This shop is located on the huge Auburn transfer site, not far from the steam repair shop and roundhouses. It is of heavy concrete, brick, steel and glass construction, the main section being 230 x 75 ft. and the machine shop section adjoining 121 ft. x 50 ft. A third section, a lean-to type structure, is 110 x 12 ft. for storage of trucks and wheels. Huge expanses of glass windows and glass block panels, give unique lighting throughout. Pits are 3-level type, with subpit between the track; floor level working area and elevated cab-high platforms on steel posts. Three parallel tracks are provided in the main shop, all with side-pit lighting. Three tracks are provided, the longer for the 4-unit Diesels and the shorter for switchers or locomotive units. A 25 ton P & H crane is fitted.

Electric motors and generators are sent to south Tacoma shops for rewinding and repair. An 80-ton Manning, Marwell and Moore sectional drop table is fitted to change out wheels, motors and whole truck units. The machine shop is of the most modern design and equipment and the parts cleaning rooms are well equipped.

A Refinoil lube oil reclaiming unit is fitted. Distilled water, lube oil (old and new) and fuelling facilities are fitted, as well as a large wash track are fitted inside and outside. Running gear is cleaned outside.

For a railroad wedded to dirty coal, steam power, the Northern Pacific's forces have literally leaped at the chance to work on something of a precision nature, requiring hospital cleanliness, and the old days of winking at a 1/4-inch tolerance on a steamer, have neatly and eagerly given way to respecting the cleanliness and precision in working with the 1/10,000 inch tolerances necessary on Diesel locomotives.

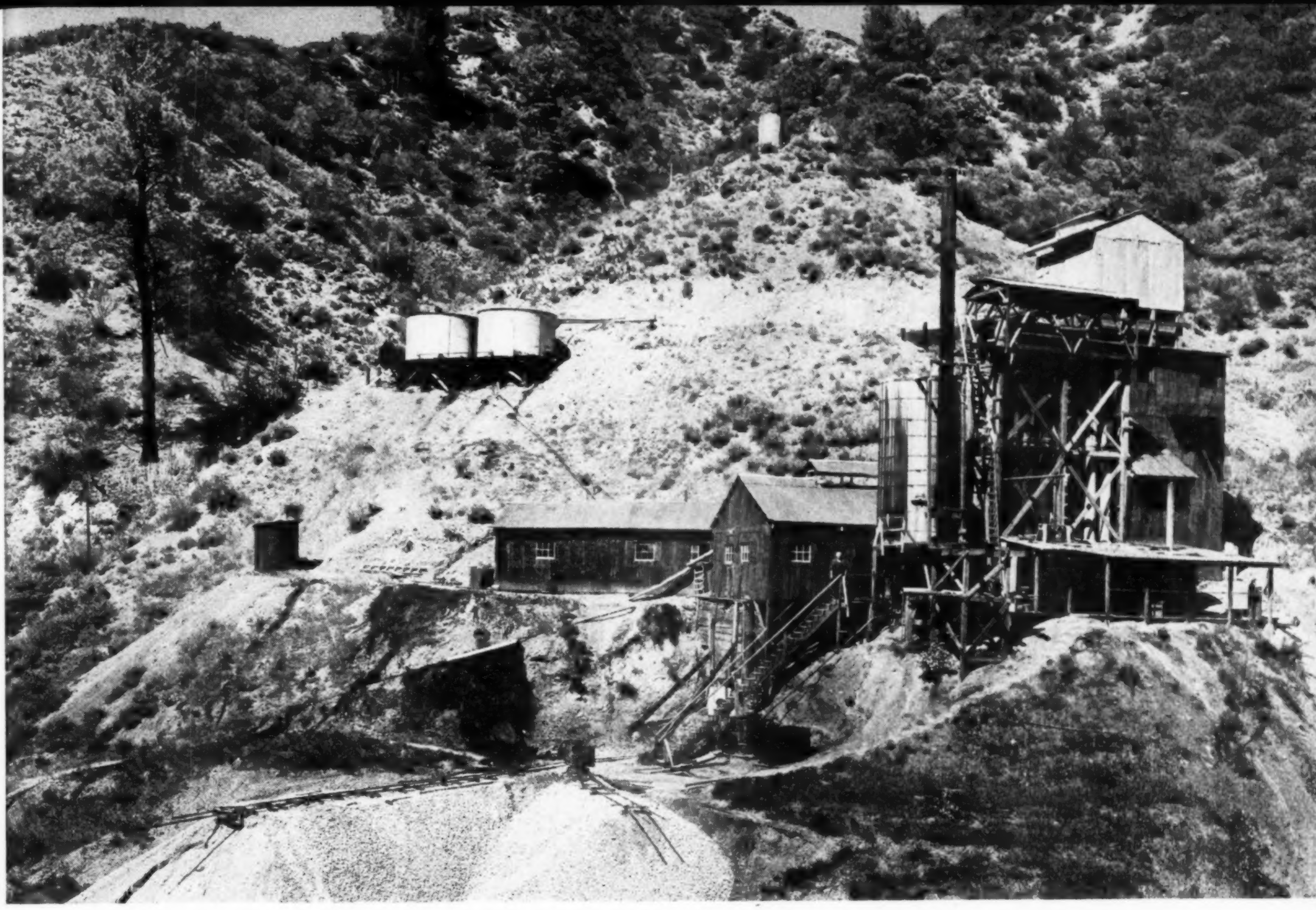
The Northern Pacific has done a splendid job with its Diesel operation so far, and its Diesel progress will be watched with great interest by all of the nation's big-league coal burning railroad systems. Especially when the nation goes without coal for extended periods.

North Pacific's Diesel maintenance crew at the Auburn maintenance shops.

COST PER ENGINE MILE OF LOCOMOTIVE SERVICE EXCLUSIVE OF CREW WAGES

	YEAR OF 1945 Steam #A-3-4-5	Steam Z-6-7-8	Steam 5400 H.P.
Fuel	.2817	.4069	.4147
Repairs—Running	.2039	.2393	.1875
Eng. House Expense	.1171	.1171	.0280
Lubricants	.0148	.0148	.0589
Other Supplies	.0060	.0060	.0052
Water	.0227	.0227	—
Cost	$.6462	$.8068	$.6943
Shop Repairs, Est.	.0677	.1426	.0875
Total Cost	$.7139	$.9494	$.7818

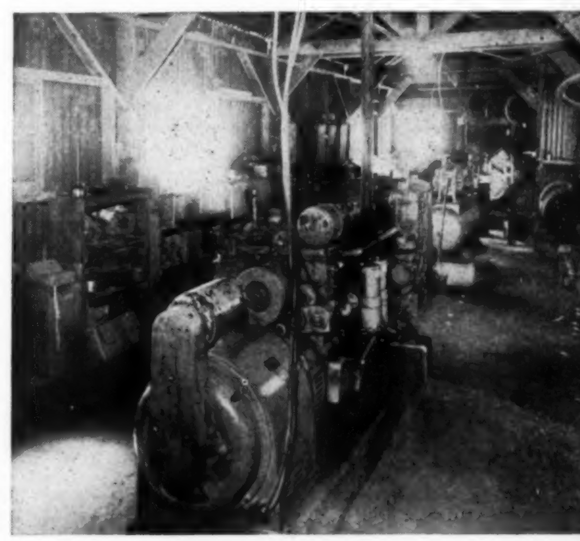
Freight Service

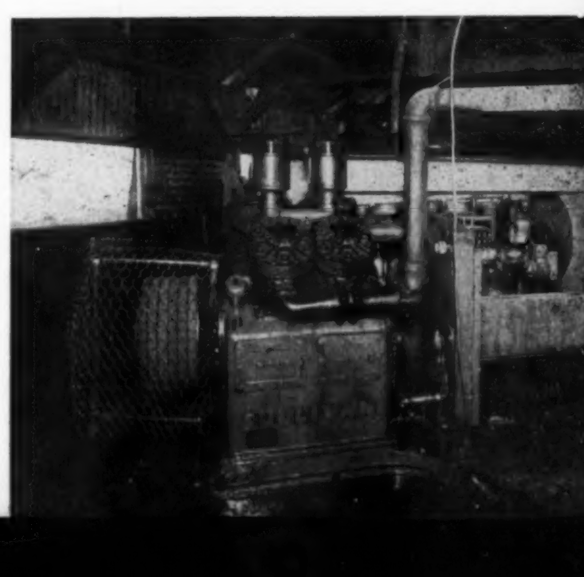


In the Santa Barbara Mountains of California is the Red Rock Quicksilver Mine shown here. Its distance from civilization requires independent Diesel installation to supply all power needs.

DIESELS DIG DEEP FOR QUICKSILVER

THE operations of the National Mining & Milling Co. of Solvang, California, in their Red Rock Quicksilver Mine at Happy Canyon, California, present countless problems in power generation. Situated in the rugged Santa Barbara Mountains, some 50 miles from the city of Santa Barbara, the enterprise is removed from normal power lines. Its operators have found the solution to their problems with the utilization of two "Caterpillar" Diesel engines which provide ample power for all operations. A Caterpillar Diesel engine powers a 15 hp. compressor, a 3½ hp. furnace motor, a 3½ hp feeder motor, a 15 hp. blower motor, a 10 hp. water pump motor and three auxiliary motors in the 50-ton quicksilver producing mill. In addition it provides the mining camp lighting power and powers freezing units in the cook house. Another Caterpillar Diesel operates a Sullivan compressor and a Sullivan drifter which serves five drifts, the longest of which is 1200 feet. It also is called upon for one of the most vital tasks around the mine, that of furnishing air for drilling in the mine at tremendous depths beneath the earth's surface. Since their installation in 1941 the engines have compiled remarkable hour meter recordings, the first showing more than 30,000 heavy duty hours and the second registering approximately 9,000 hours. This is another instance of Diesels taking over a tough job in isolated territory and doing it well.

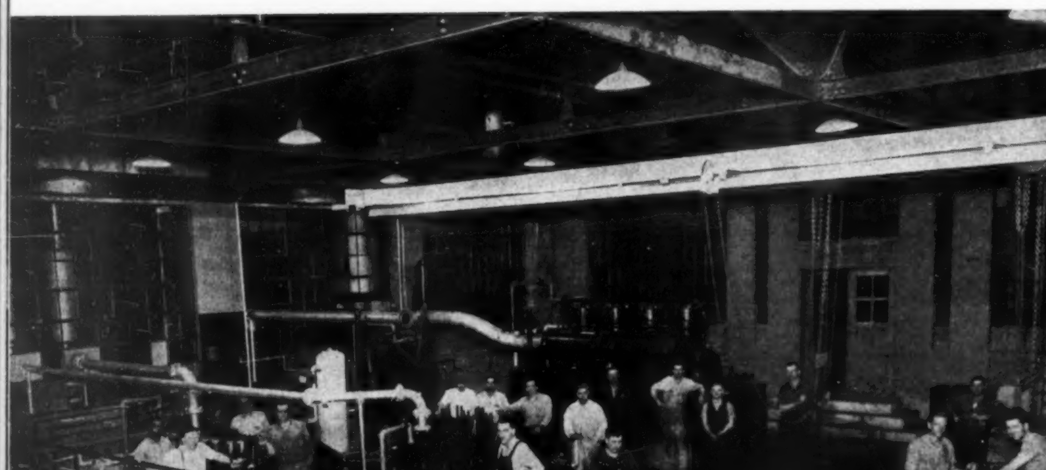


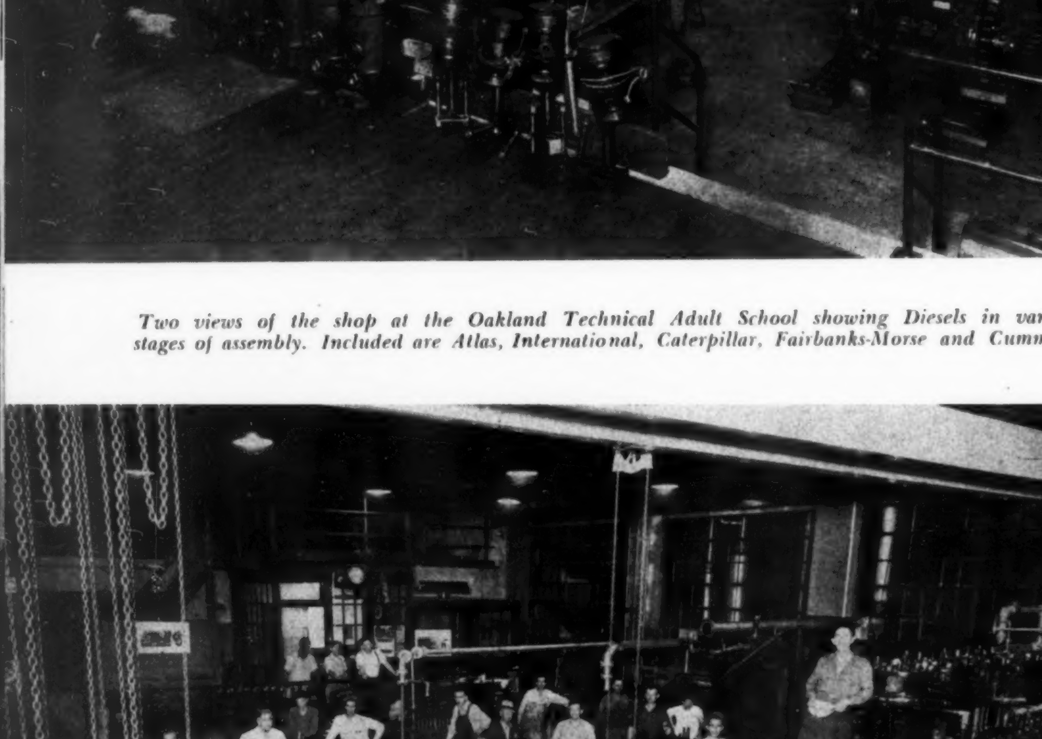


(Upper right) Caterpillar Diesel seen here has operated over 30,000 hours supplying light and power to the mine. (lower right) Caterpillar Diesel driving Sullivan Compressor furnishing drilling air.

OAKLAND PUBLIC SCHOOL IS MODEL FOR TRAINING DIESEL MECHANICS

By HAROLD D. ELLIS





Two views of the shop at the Oakland Technical Adult School showing Diesels in various stages of assembly. Included are Atlas, International, Caterpillar, Fairbanks-Morse and Cummins.

IN every section of the country there are today educational facilities for young men to become trained engineers, thus fitting themselves for the Diesel engine field. There is a scarcity, however, of similar facilities for equipping young men who want to become Diesel engine operators or mechanics, with a background of machine shop experience.

That is the reason why it is gratifying to find an institution like the Technical Adult School of Oakland, California which, unlike most schools on its level, is conducted as part of a public school system. So good a job is this school doing that it may be said to be a model that could be followed by other public school systems throughout the country.

The Oakland Technical Adult School has $87,000 worth of engines, equipment and tools, with more engines and equipment on order. Since 1941 it has turned out 185 graduates. The present whereabouts and occupation of 90 per cent of them are known to the school's instructor. Every man has a responsible position in some phase of Diesel engine operation and maintenance, and is paid substantial wages. Demand for graduates always exceeds the supply.

To do a good job, a school of this type must have three things:

1. Able teaching personnel .

2. Adequate equipment.

3. Proper balance between class room and shop work.

Taking these in order, it is time to introduce Charles B. Graves, the school's chief instructor. Mr. Graves' background in Diesel engines goes back to 1916, when he began working in a Diesel generating plant. Later he acquired extensive experience in marine Diesel engine installation and operation. He now holds a marine chief engineer's license and Class A vocational school credentials, acquired from the

State of California Department of Education, entitling him to teach in any adult school, junior college or high school in the State.

Aside from his teaching activities, Mr. Graves is employed by the Moore Dry Dock Co. of Oakland. He supervises Diesel engine repairs and acts as consultant for 190 purse seiner owners whose activities extend from Seattle to San Diego. He advises them on hull construction, hull repairs, Diesel repairs, refrigeration and ship conversion. This position enables him to place graduates who can fill the company's requirements, who can act as engineers on purse seiners and tuna clippers.

Shortly after meeting Mr. Graves, one sees the type of teacher he is—hard working, serious, but easy to get along with. He is a constant reader of technical books and trade magazines. The length of the course he teaches is from 18 to 24 months in the Diesel shop, a month consisting of 120 clock hours. Paralleling this course, the student is required to carry from 24 to 84 hours per month in the machine shop. He takes the latter course at night. Before admitting an applicant to the school, Mr. Graves interviews him, and if the aspirant patently lacks the zeal or the intelligence to master the work, he is advised not to enter. Every so often during the time it takes a student to complete the course (depending upon his ability), Mr. Graves has further talks with him, and if he is not making satisfactory progress, he is discouraged from continuing.

Supervising Mr. Graves' work is Dr. F. Milton Yockey, Principal of the Technical Adult School, likewise an earnest educator whose ideal as he expressed it is to "organize classes for all vocations, to help men and women meet life's problems to better advantage."

The school's equipment catches your eye when you enter the shop which has nearly 3,000 square feet of floor space, housing the 16 engines (all in running condition) and the 25 students who work on them. A list of those engines follows:

1—300 hp. 4 cyl. Fairbanks-Morse direct reversible marine type with heat exchangers for lube oil and cooling water, two electric auxiliary fuel oil and water cooling pumps, and a snubber for exhaust.
1—120 hp. 4 cyl. Atlas stationary type with lube oil and cooling water heat exchanger, auxiliary electric fuel and water pumps, and snubber for exhaust.
1—120 hp. 8 cyl. Fairbanks-Morse railroad or generating type.
1—65 hp. 4 cyl. Cummins truck type.
1—32 hp. International Harvester 4 cyl. crawler tractor type.
1—35 hp. 4 cyl. Caterpillar bulldozer type.
3—225 hp. 6 cyl. General Motors, Gray Marine conversion.
1—147 hp. 6 cyl. Hercules supercharged Navy marine type.
2—6 cyl. Buda generating type.
1—6 cyl. Buda truck type.
2—32 hp. 3 cyl. Winton generating type.
1—30 hp. 4 cyl. Listard heavy duty type.

All of the foregoing engines are mounted on heavy duty bases and are connected with fuel tanks and with all the piping for intake of fuel, cooling water and exhaust. A 1,100-gallon fuel oil deep tank is kept well supplied with Diesel fuel oil. The test of the students' workmanship is that the engines run satisfactorily after each group has completed its assignment on them.

The school has additional engines on order from War Assets Administration as follows:

1—400 hp. Enterprise turbo-supercharged marine type.
1—850 hp. Fairbanks-Morse opposed piston railroad type.
1—250 hp. 6 cyl. Superior stationary generator type.
1—1200 hp. 12 cyl. General Motors railroad V-type.
1—275 hp. 6 cyl. Cummins truck type.
1—300 hp. Busch-Sulzer marine type.

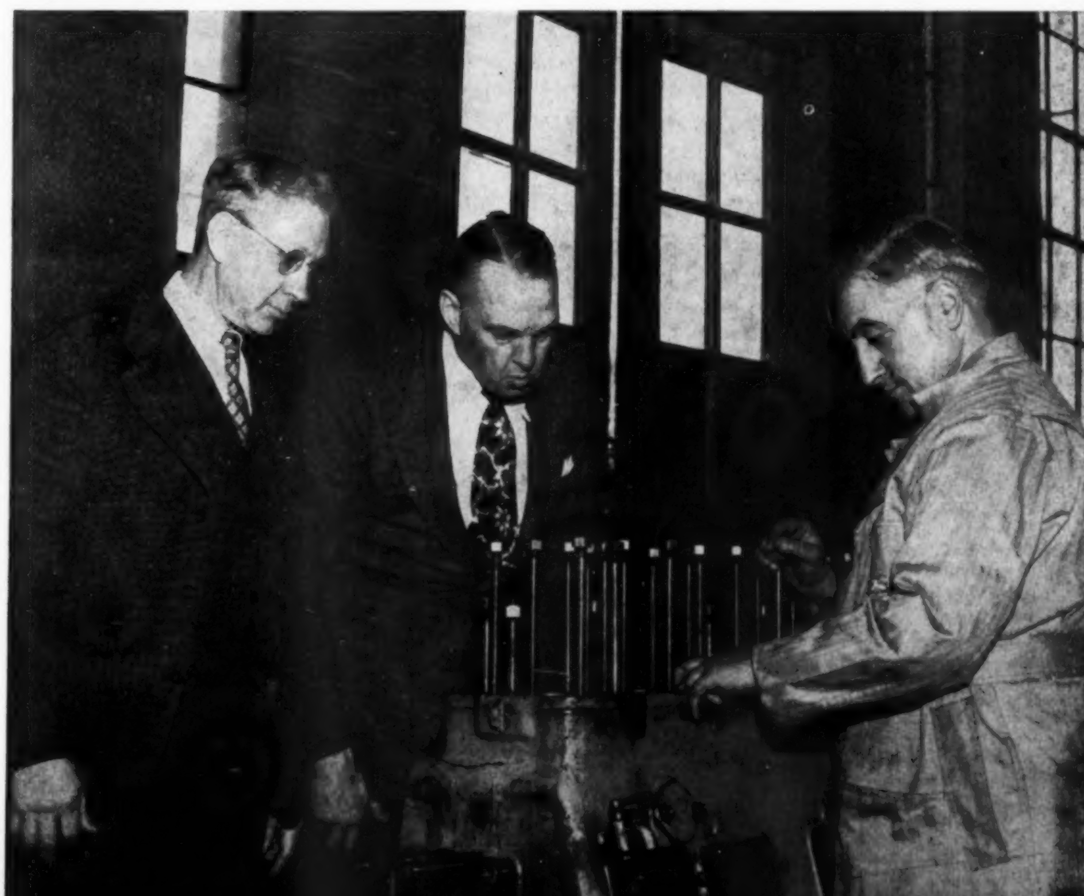
Aside from its engines, the Oakland Technical Adult School Diesel shop has a good array of equipment, instruments and tools. There is a seven-ton overhead crane, which cost $5,000 and is Mr. Graves' special pride. A pressure cylinder indicator used by the students cost $325. There is a full set of micrometers, surface gauges, hydrometers for measuring the specifying gravity of Diesel fuel oil and lube oil, speed indicators, dial test indicators for general purpose work, and scales for weighing small moving parts of engines. Additional equipment on order includes a large drill press, a hydraulic press, an 18-inch lathe and a milling machine.

As to the third requisite of a good vocational school—proper balance between lecture session and shop work—Mr. Graves gave an explicit answer.

"We start off with a half-hour lecture every day," he said. The rest of the time is spent in the shop disassembling, "miking" and writing a complete notebook with drawings, and fitting up assembly on each engine, with a group of five students on every engine in the shop throughout the course."

That schedule indicates the type of graduate the school turns out. Mr. Graves enlarged on the topic as follows: "He is a journeyman or nothing," he said. "By that I mean a Diesel engine machinist who can repair any make or type of Diesel engine, and who can make his

(Left) Dr. F. Milton Yockey, principal of school and H. D. Ellis hear Charles B. Graves, Diesel Engine instructor (right), explain a mechanical problem.



own parts. To teach him to make those parts, we hold four machine shop sessions every week in another part of this school.

"A man who graduates from here, if he has properly absorbed the training we can give him in the machine shop, and in Diesel engine work — marine Diesels, for example — is equipped to be a chief engineer on a purse seiner or a tuna clipper, with a good knowledge of refrigeration. Marine engine operation and maintenance are conducted here just as they would be aboard a ship. The same idea in training holds good in other applications—for example, trucks, or Diesel-operated cranes, or road building machinery."

Supplementing the work the students do in the laboratory are "Field trips." These are taken about every three weeks to Diesel engine factories, shipyards, shops and power plants, and to the shops of Diesel tractor and truck dealers, so that the students can observe how others test, operate and repair Diesel engines. Factories which have been visited include Atlas Imperial Diesel Engine Co., Enterprise Engine & Foundry Co., Lorimer Diesel Engine Co., Union Diesel Engine Co. and Joshua Hendy Iron Works. Dealers representing International Harvester Co. and Caterpillar Tractor Co. have likewise been visited.

At present 51 students are attending the school —all are war veterans, with an average age of 26. Twenty-six of them are in day classes and 25 attend at night. In the day classes are "pre-employment" students—those who are preparing themselves for jobs. Night classes are for those who are employed, but who are ambitious to hold better jobs, or "to learn to do their own job better," as Mr. Graves expressed it. Still others go to night class for brush-up purposes. Day classes are held from Monday through Friday, six hourse a day. Night classes consist of three-hour sessions, held twice a week.

There are no special entrance requirements—the interview that Mr. Graves has with an applicant is the principal criterion as to his fitness for undertaking the course. At the end of the year and a half, or two years required by the student to complete the work, he receives from Mr. Graves a form letter stating he has satisfactorily covered the ground. This letter is accompanied by one of a personal nature telling more definitely what the graduate is able to do, and how well he should be able to do it.

Besides the letters, the school gives to any student who leaves the school, whether he is graduated or not, a vocational training record card. The card is issued by the U. S. Office of Education and is accepted any place in the country, Dr. Yockey said. It shows the number of hours the student has spent on each division of his assignment. Purpose of the card is to give the student the recognition he deserves, even though he completes but a part of his course. A Progress Chart, posted in the class room, has the same headings that are printed on the vocational training record, and the squares opposite each student's name are filled in under each unit, so that by consulting the chart at any time the student can check his record.

At present the school has a waiting list of 60 applicants for day classes and 20 for night. Its 12-year record of accomplishment (it was started in 1934) and its almost negligible fees ($2 for registration, $3 for use of tools), attract many more to its doors than can be admitted. This fact brings home once more the acute need for more schools of this practical type, where students acquire not merely laboratory experience, but machine shop experience. In the future this need will become even more sharply accentuated, for use of Diesel engines is going to be tremendously increased.

What Oakland, California has done, any other city of its size in the United States can certainly do. The three basic requirements have been stated—able teaching personnel, adequate equipment and a well balanced, well planned course of instruction.

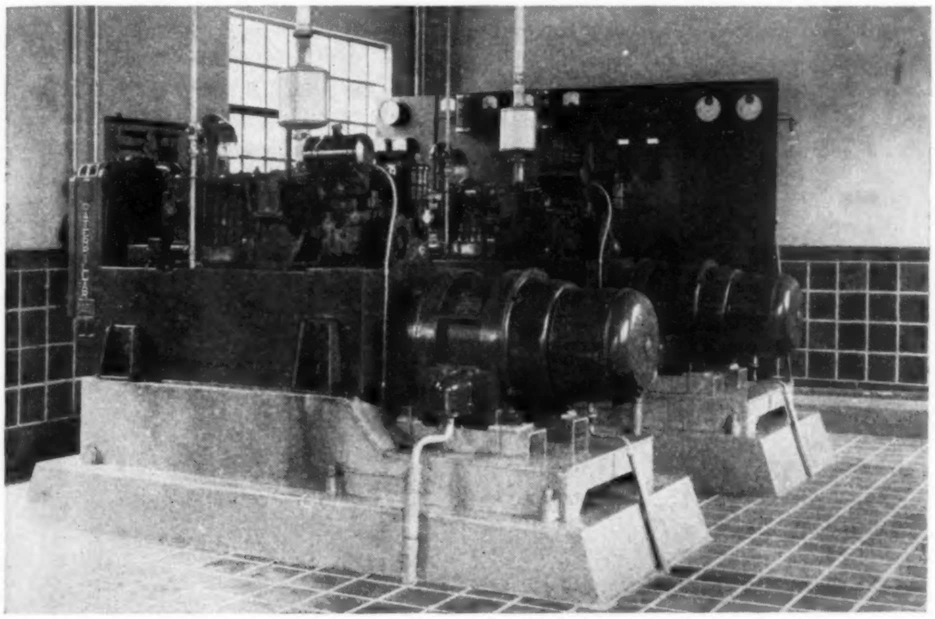
TRAINING PROGRAM FOR DAY AND EVENING CLASSES IN DIESEL ENGINE OPERATION AND MAINTENANCE, CONDUCTED BY THE TECHNICAL ADULT SCHOOL, OAKLAND, CAL.

1. Inventor of the Diesel Engine.
2. Four stroke cycle.
3. Two stroke cycle principle.
4. Two cycle surface ignition oil engine of semi-diesel.
5. Two cycle full Diesel type.
6. Air injection system.
7. Solid injection system.
8. Airless injection system.
9. Diesel engine frames, and installation work.
10. Lubrication and temperatures.
11. The parts requiring lubrication and why.
12. Selection of lubricating oils.
13. Cleaning, centrifuging and filtering lubrication oils.
14. Importance of exhaust temperatures.
15. Cooling system, open type.
16. Cooling systems, closed type.
17. Main bearings and crankshafts.
18. Pistons and piston pins.
19. Connecting rod bearings.
20. Cylinder and cylinder heads.
21. Admission and exhaust valves.
22. Fuel valves of air injection engines.
23. Fuel pumps of air injection engines.
24. Fuel injection nozzles and pumps of solid injection engines.
25. Fuel injection nozzles and pumps of airless injection systems.
26. Diesel fuel oils and their care.
27. Single and three stage air compressor systems.
28. Determining the H.P. of Diesel engines.
29. Governors and their care.
30. Four and two cycle double acting Diesel engines.
31. Steam boilers, engines, turbines, electric dynamos and generators.
32. Operating procedure.
33. Reversing a Diesel engine.
34. Exhaust boilers and exhaust turbine-blowers.

Another view of the shop shows a General Motors Diesel at left and a Buda in right foreground.

COAL MINE IN ANDES DIESELIZED

ALTHOUGH located high in the Andes, the town of Sesquile, Columbia has modern power facilities for its inhabitants. The seeming contradiction of seeing an isolated mountain community becoming acquainted with the wonders of modern civilization is explained by the presence of modernized industry in the near vicinity of Sesquile. Carbonera San Vincente, the largest coal mine hacienda in Columbia, has installed Diesel horsepower to replace the time-honored ox power of the region. Back in 1940, Dr. George Martin, Belgian minister to Columbia and owner of the mine, installed two Caterpillar Diesels to supply electric power to both the mine and the town.

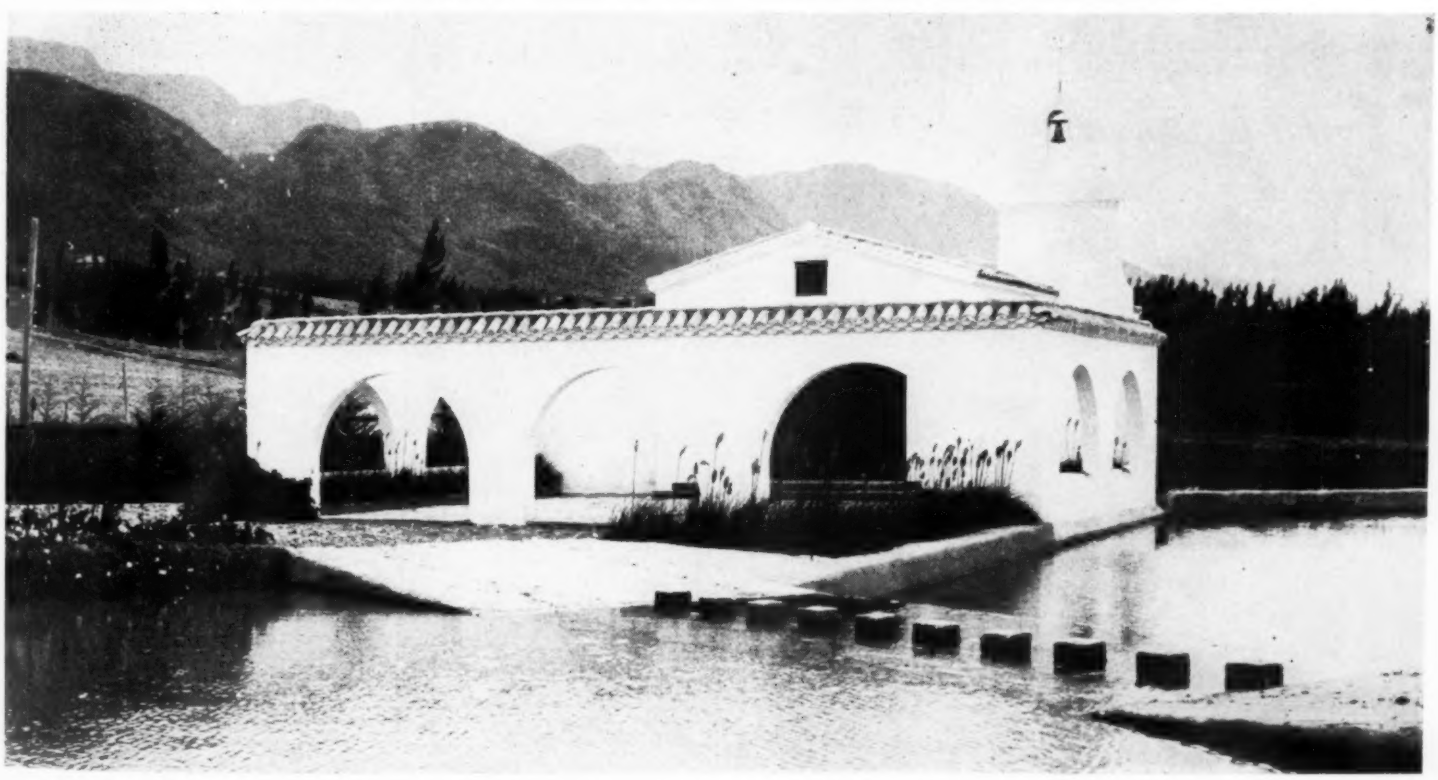


Modern Diesels seen here power Andes coal mine as well as nearby town. "Caterpillar" in foreground has operated 24,000 hours.

At the mine the Diesels provide current for operating all the electrical equipment including an electric hoist and water pumps in addition to the machine shop. This machine shop by the way is as modern as any of comparable size in the United States, being equipped with a 78-inch lathe, two metal saws, grinders, drill presses, and a 300 ampere arc welder.

The town of Sesquile is located four miles distant from the mine and power lines carrying 2400-volt current from the mines supply homes, stores, schools, streets, and churches. Before the introduction of Diesels, a steam generating plant was used but mine officials now say that with Diesels the cost of current generation has been cut by 60 per cent. The mine produces 4,000 tons of coal a month.

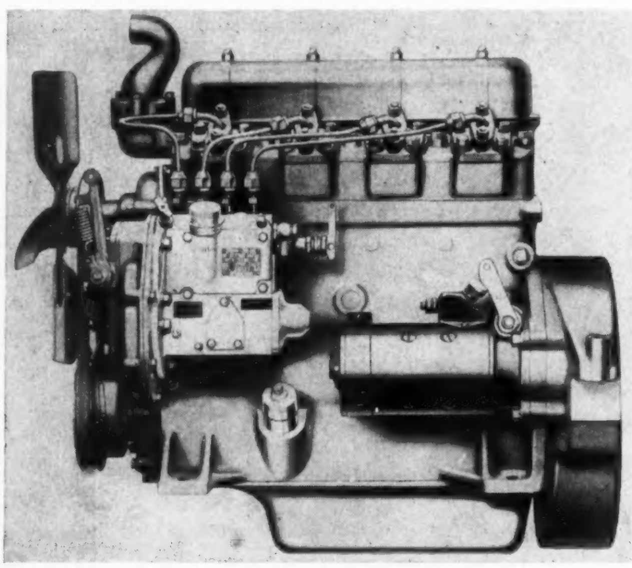
Beautiful new chapel at Carbonera San Vicente where miners and families meet on Sunday.



WAUKESHA BUILDS NEW DIESEL

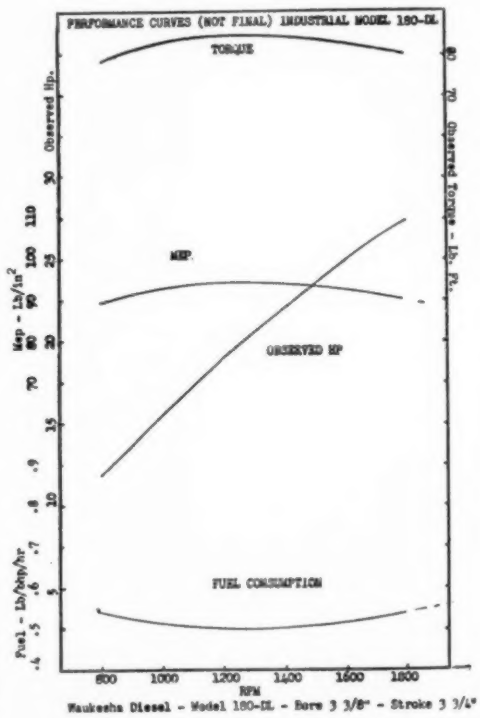
FROM the city of Waukesha, Wisconsin comes word of a new full-Diesel engine line now in production at the Waukesha Motor Company plant. This new line of Diesels represents the culmination of a Diesel development program dating back to 1926. This new series of Diesels has passed a set of rigid tests under service conditions varying from arctic to tropical climates and has been proven suitable to meet the requirements for industrial or automotive service. War tested materials and improved production techniques have gone into this new Diesel. These innovations include hardened crankshafts, controlled water circulation and new lubricating systems.

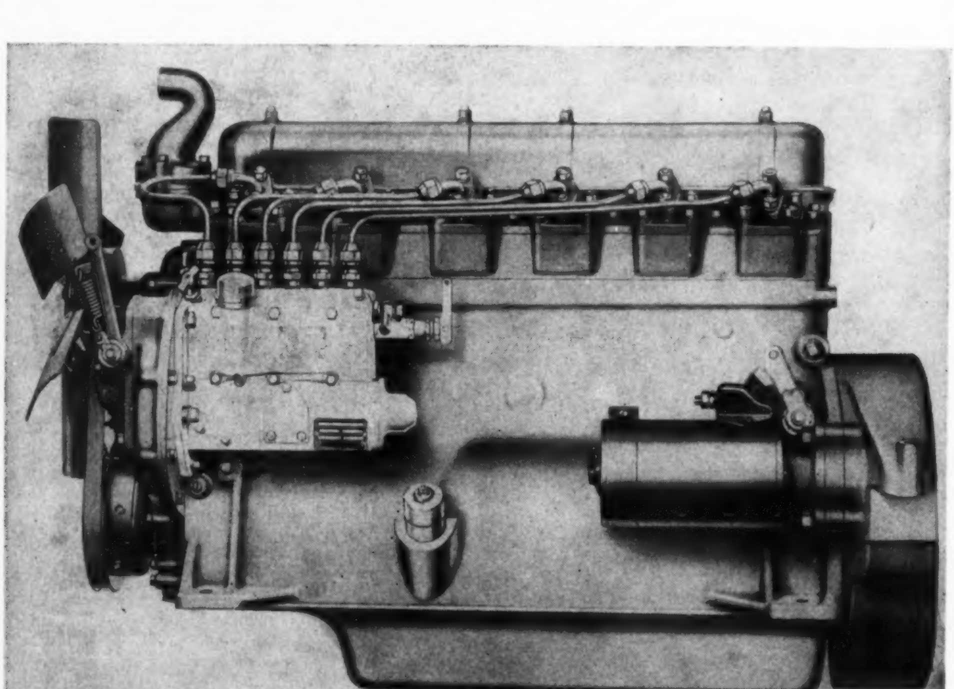
At present four types are ready for the market: an 1197 cubic inch, six cylinder industrial Diesel; a 248 cubic inch, six cylinder tractor and industrial model; a 779 cubic inch automotive Diesel with six cylinders; and a small four cylinder model with a displacement of 134 cubic inches. All four of these engines are pictured on these pages. For automotive duty the two smaller models are supplied with aluminum pistons in place of the standard cast iron type. However, the two larger engines are equipped with heavy duty aluminum pistons for either service. Lubrication on all models is accomplished by a pressure spray system. American Bosch fuel injection equipment is used on all models. The performance curves below are of a preliminary nature.

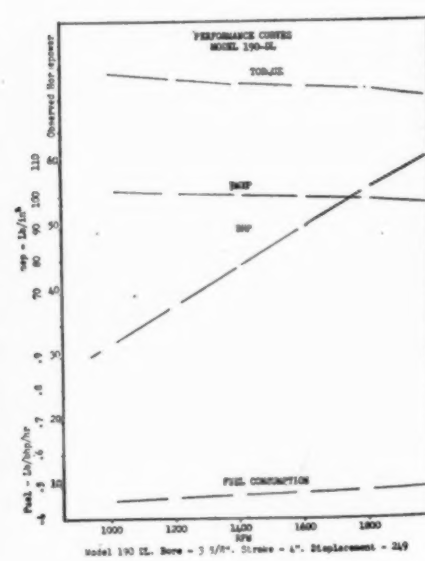


At left is the Waukesha 4-cylinder, Diesel model 180-DLA 3⅜ in. bore and 3¾ in. stroke. Displacement — 134 cubic inches. Test curves reproduced at right indicate that the engine will develop 25 hp. at 1600 rpm.

Seen below is the new six cylinder, 3⅝ in. bore and 4 in. stroke. Waukesha Diesel. Displacement — 247 cubic inches. Performance curves at lower right show a horsepower of over 55 at 1800 rpm. Note American Bosch fuel pump assembly.







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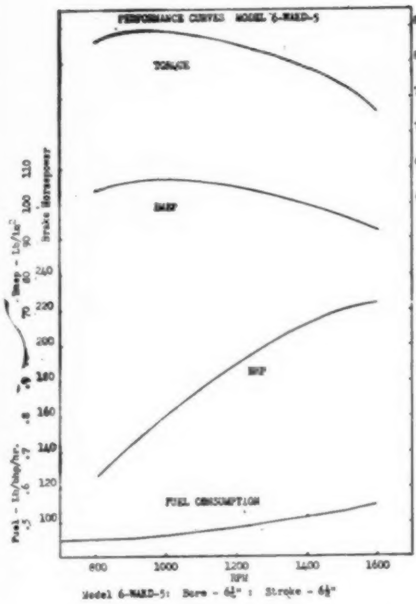
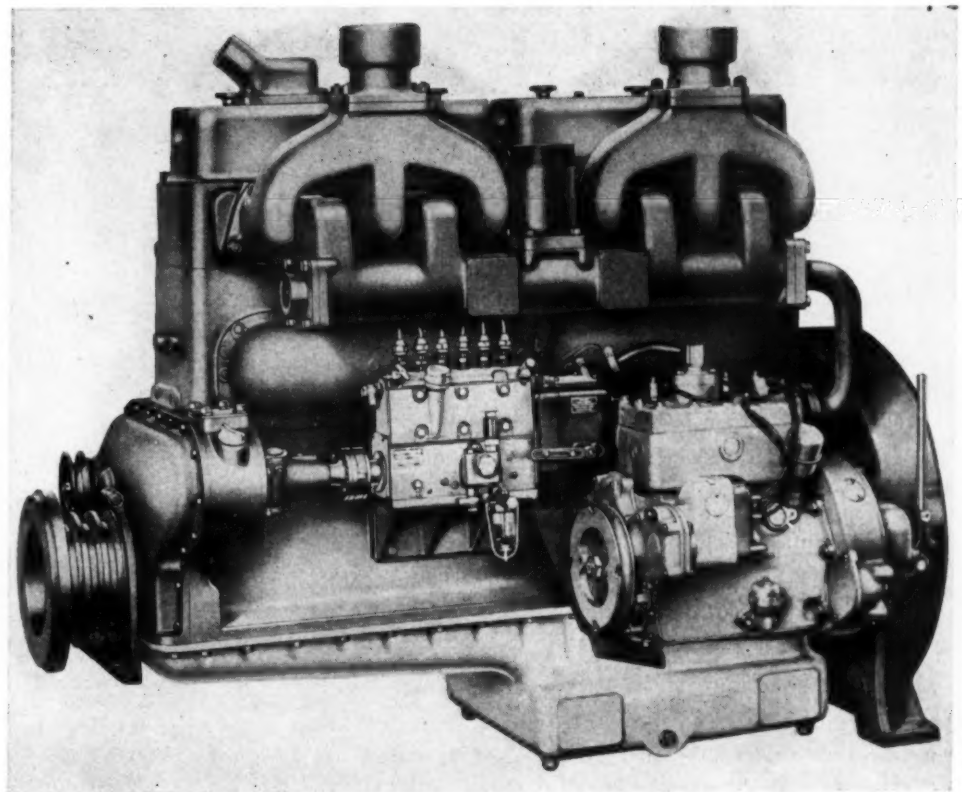
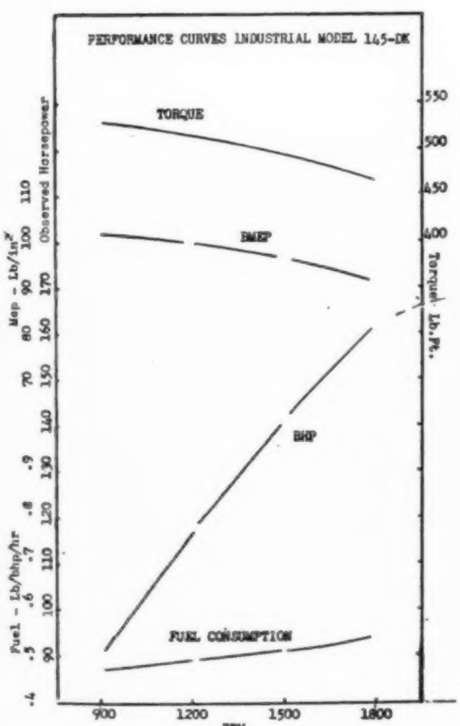


Performance curves for Model 6-WAKD Diesel showing a test bhp. of 222 at 1600 rpm.

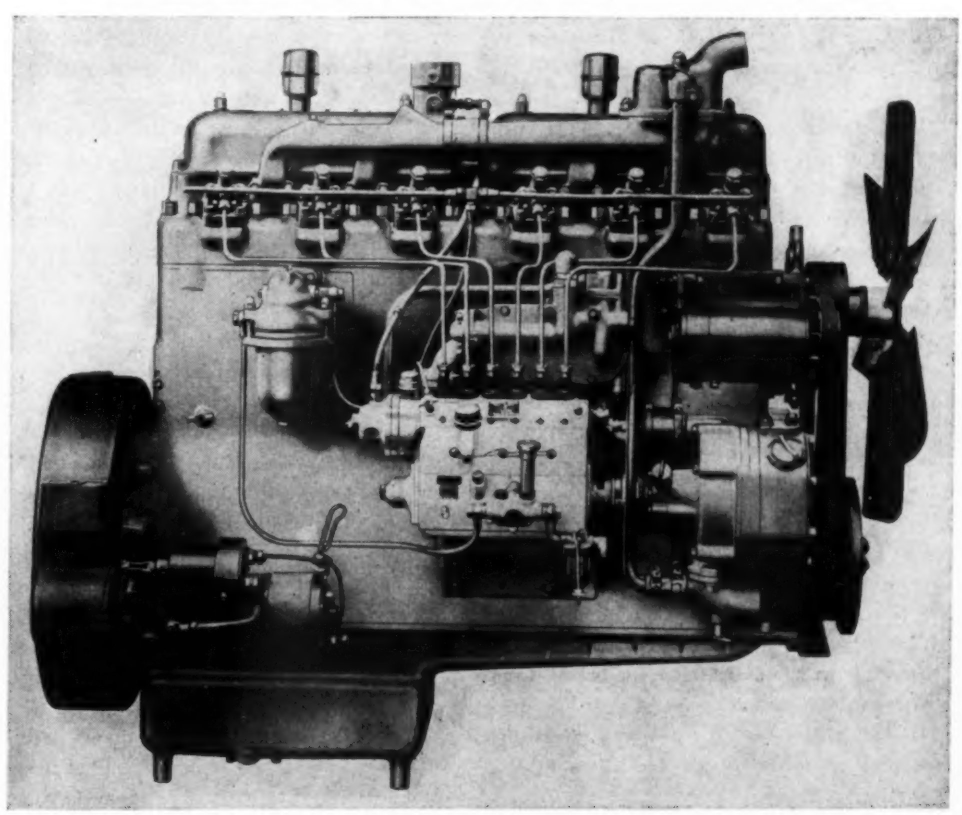


Largest of the new Waukesha line is this 6-cylinder industrial model. Bore—6¼ in., stroke—6½ in., displacement—1179 cubic inches. Engine is equipped with small gasoline starting motor as optional equipment.

(Below) Performance curves of Waukesha Diesel Model 145-DK show 162 observed hp. at 1800 rpm.



Second largest in new Waukesha Diesel line is this 6-cylinder industrial and automotive model pictured below. Bore 5¼ in., stroke 6 in., displacement—779 cubic inches.



A DIESEL BUILDER TALKS IT OVER

***By* F. HAL HIGGINS**

YOUR Old Reporter piled into his car and drove over to the Union Diesel plant to call on Manager S. W. Newell recently to learn just what is cooking at Union Diesel and how the old Diesel engine builder came through the late fuss in furnishing products to a Government that made such insatiable demands on the industries of the U. S. He knew Union's Fischer was not a man to be hurried into mass production of a product he had spent a lifetime building into a precision operation.

"Our entire product went to the U. S. Navy during the war," explained Mr. Newell. "Mr. Fischer's policy under such Navy demands for more engines was to ask us if the Navy suggestions were any better, or as good as our methods. The Navy knew what everybody was doing in Diesels in this area, of course, and knew some firms could and did get bigger production by adopting short cuts in their factories. The Navy understood our point of view, and also the urgent need of more Diesels. The Navy took over 96% of our production during the five years from 1940 to 1945. For over three years not one Union Diesel engine went to a commercial customer.

"The United States Navy in 1945 commissioned a spanking new thirty-ship 'task force' to patrol and supply its far-flung Pacific bases. This group of vessels is not a task force in the usual wartime meaning of the phrase, but certainly is in the literal sense—for the YP (Yard Patrol) class has performed a wide variety of tasks. The design of the new YP class came directly from the famed tuna clippers which for so many years have plied the wide reaches of the Pacific to help feed the Nation.

"It was no accident that the new YP class should be an almost exact replica of the sturdy fishing vessels. Many tuna clippers were taken over by the Navy early in the war and put into service as vital units of a hard-pressed fleet. These rugged little craft have performed so amazingly well under extreme conditions—from bases in the Aleutians to those below the equator—that there was no guess-work when the Navy contracted for its own specially built fleet of these vessels.

"The heavily-constructed clippers occupy an unique place in the marine field, for their work requires that they roam far afield and within range of such weather as Mexican 'chubascos' and tropical hurricanes. For this reason they are designed for the greatest possible seaworthiness and are provided with engines of great power and dependability. Their auxiliary power plants must be rugged too, because even a brief break-down in refrigeration equipment may result in loss of weeks of work and thousands of dollars worth of hard-caught tuna.

"Tuna clippers often must travel great distances to their fishing grounds—cruises of 7,000 miles or more not being uncommon—and thus have a large bunker capacity. Furthermore, they are built to carry a large amount of cargo in proportion to their size, while their draft permits them to enter many harbors not accessible to larger vessels.

"Early in 1944 when the Navy decided to build its own YP fleet, it was not surprising that the most modern tuna clippers were used as models. The Union Diesel Engine Company was awarded a contract to build thirty main propulsion engines and sixty generator sets to be used as auxiliaries for the new flotilla. A contract was let to the Harbor Boatbuilding Co., of Terminal Island, for design of the vessels and each of fifteen Pacific Coast yards received contracts to build two 'Yippies,' the total program amounting to approximately $15,000,000.

"It is interesting to note that the Navy, which called upon the fishermen when they needed the tuna clippers for fighting purposes, has likewise created a possible reserve supply of fishing craft. The YP 617-646 class can be readily converted to commercial purposes should Naval authorities decide at any time that they no longer are necessary for official purposes. In their design the chief departures from typical clipper practices are those required for armament and other Naval equipment and the provision of space for about twice as many men as a tuna vessel normally carries. Circulating brine and fresh water pumps, essential for tuna fishing, have been omitted but there is ample space in the engine room for them. There is also space for installation of superchargers on the Union engines if desired.

"The 700-ton Navy craft are 128 feet in length, with molded beam of 29 feet and a 14-foot draft. There is capacity for 300 tons of refrigerated cargo, arrangements for stowage following the tuna clipper pattern. There is a two-compartment tank on deck aft (ordinarily used on tuna clippers for bat) and nine wells below deck. The forward wells are of steel, heavily insulated with cork. They can be used for fuel oil and, with the regular fuel tanks, provide a capacity of approximately 25,000 gallons. The other wells below decks are constructed of wood and have no insulation. The deck tank is cork-insulated on top. All tanks and wells are refrigerated. The close-spaced cooling coils are of special 1¼ inch ammonia refrigeration pipe. Wood construction is heavy throughout, the keel in each instance being a single fir timber 14 inches by 18 inches in section and 112 feet in length. Frames are double 6-inch sawn fir, with 2¾ inch fir planking and 3¾ inch ceiling, also of fir.

"Propulsion is provided by six-cylinder Union Marine Diesel engines, direct reversing, with 560 rated horsepower at 325 revolutions per minute. These engines have closed fresh-water cooling systems. Union Diesel's direct-control system is installed in each of the vessels, thus making possible instant engine control from the pilot house. The auxiliary Union Diesel engines are also of the six-cylinder type, direct-connected to Allis-Chalmers generators which are mounted on the same sub-base as the engines. Each generator set—there are two in each vessel—has a capacity of 125 kilowatts. Each vessel has comfortable accommodations for three officers and thirty men. The crew's quarters are on the boat deck just forward of amidships and contain three-tiered pipe berths and metal lockers. Officers' staterooms and a small wardroom are aft.

"It can be said of the YP's that they served as training ships for thousands of officers and men who were sent to sea with little previous experience and who later showed their YP experience to advantage on larger vessels."

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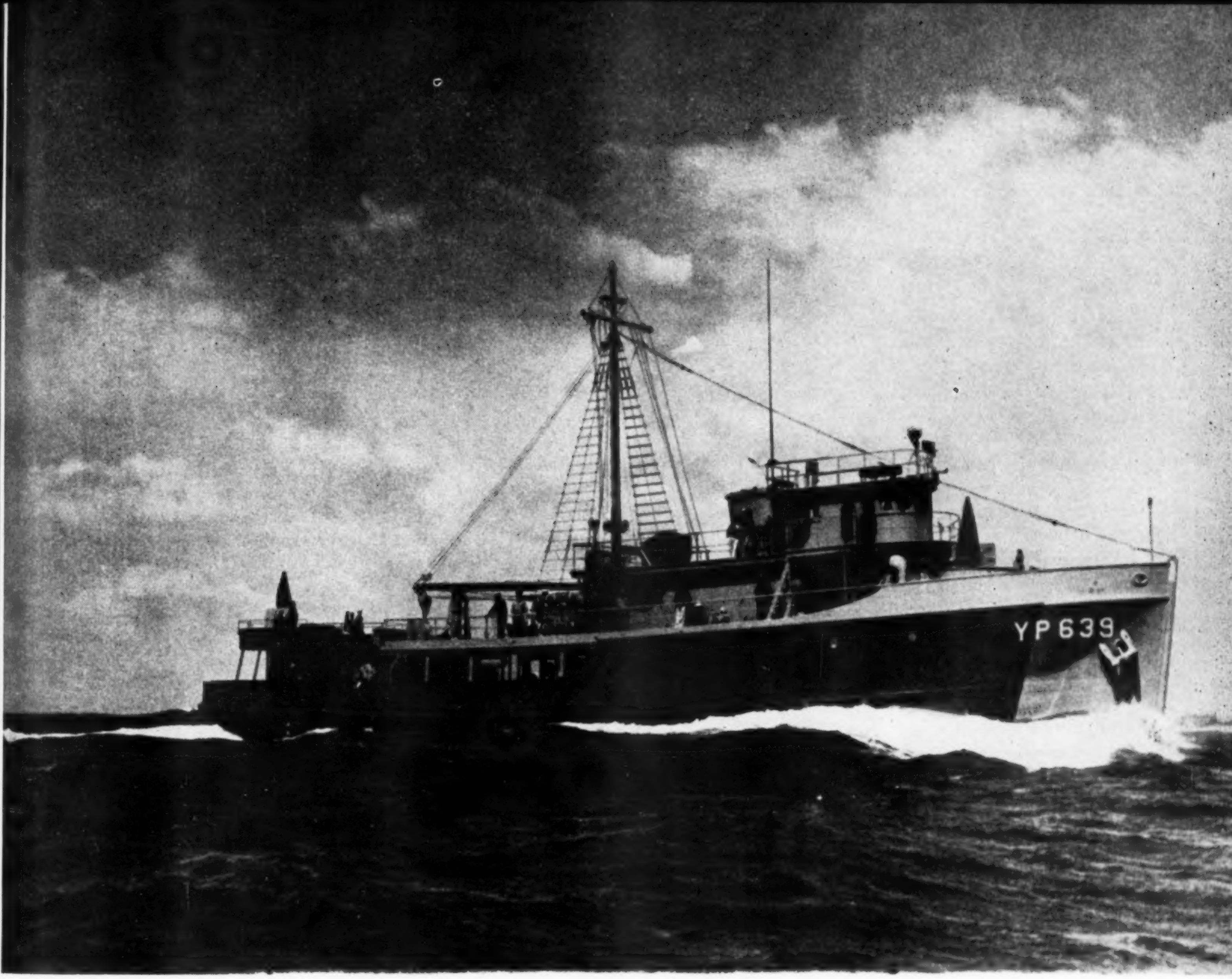
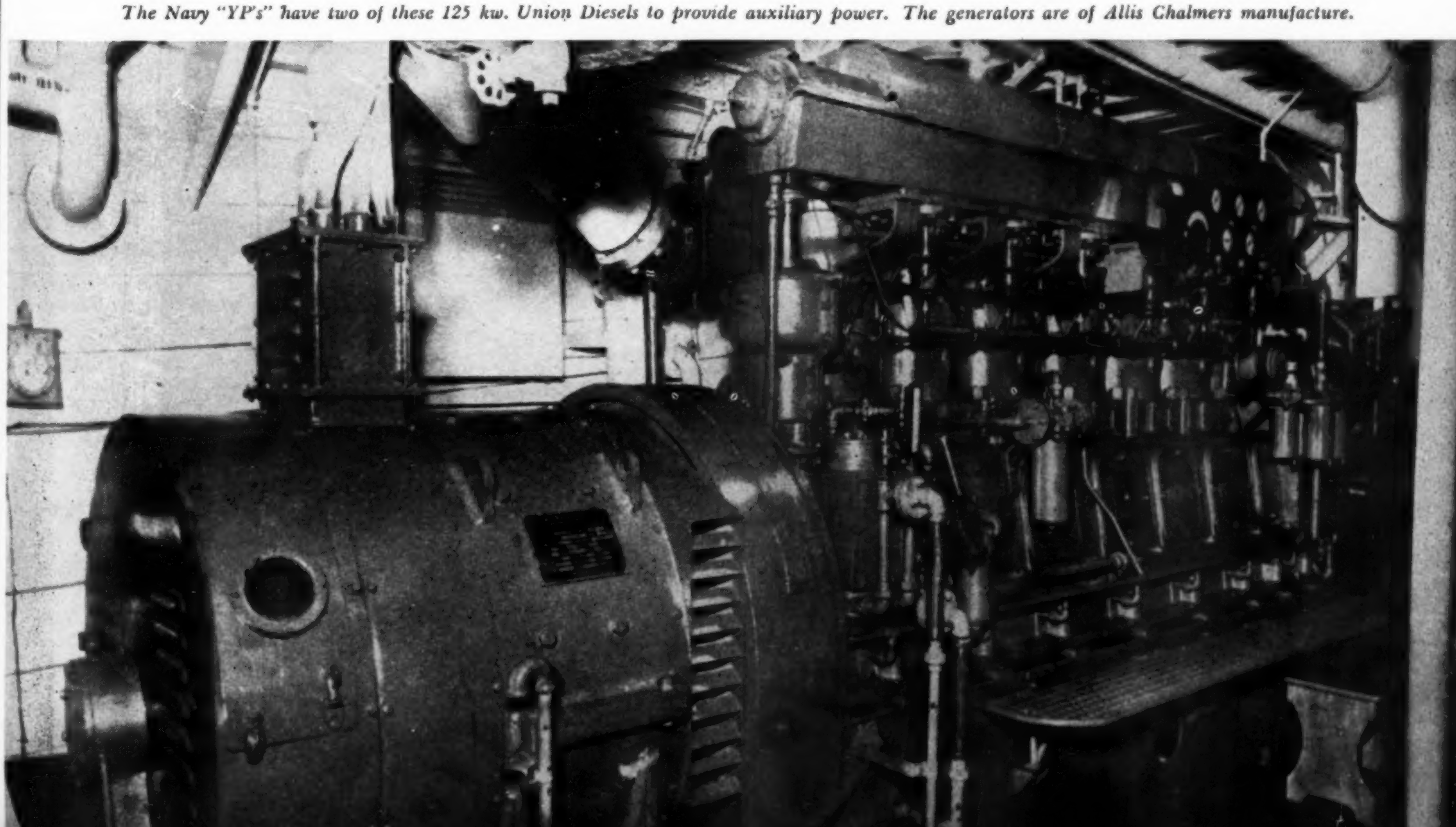


One of the Navy "YP" boats that the Navy built on the model of the famed West Coast tuna clippers. It is powered by a 6 cylinder, 560 hp. Union Diesel.

The Navy "YP's" have two of these 125 kw. Union Diesels to provide auxiliary power. The generators are of Allis Chalmers manufacture.



THE FINAL STORY OF THE JUNKERS AIRCRAFT DIESELS

By PAUL H. WILKINSON

NOW that the activities of the German aircraft engine industry have been disclosed, it is possible to review the results obtained by the Germans with their aircraft Diesels. These activities, prior to World War II, were more extensive than the public has been led to believe. Had this development been continued at the same pace, the Germans would have had ideal power plants with which to conduct their war. Transport planes powered with Diesels would have been ideal for carrying heavy loads to their far-flung fronts.

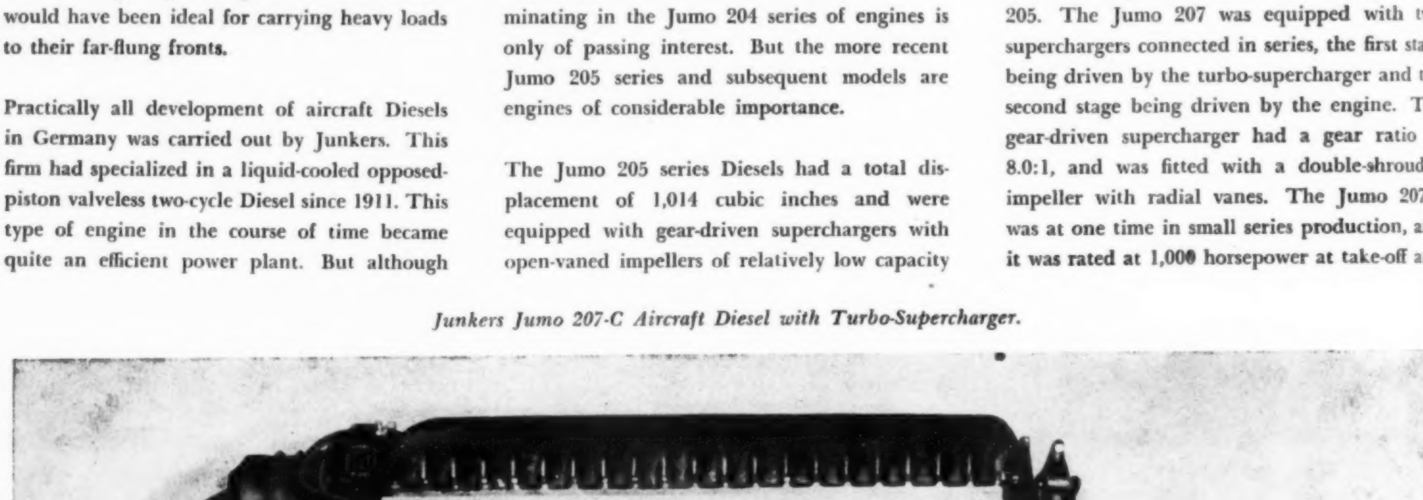
Practically all development of aircraft Diesels in Germany was carried out by Junkers. This firm had specialized in a liquid-cooled opposed-piston valveless two-cycle Diesel since 1911. This type of engine in the course of time became quite an efficient power plant. But although it ultimately attained an output of more than 2,000 horsepower, complications of servicing more than offset its fuel economy and precluded its extensive use as a war-time power plant.

Junkers designed practically all of its aircraft Diesels in the form of 6-cylinder in-line power plants with two pistons in each open-end cylinder, and two crankshafts. Earlier work culminating in the Jumo 204 series of engines is only of passing interest. But the more recent Jumo 205 series and subsequent models are engines of considerable importance.

The Jumo 205 series Diesels had a total displacement of 1,014 cubic inches and were equipped with gear-driven superchargers with open-vaned impellers of relatively low capacity for scavenging and low-altitude flying. The series included the 600 horsepower 205-C, the 700 horsepower 205-D, and the experimental 880 horsepower 205-E. The mass-produced Jumo 205-D had a specific weight of 1.64 pounds per horsepower and a specific output of 0.69 horsepower per cubic inch of displacement.

The Jumo 207 series Diesels were slightly modified turbo-supercharged versions of the Jumo 205. The Jumo 207 was equipped with two superchargers connected in series, the first stage being driven by the turbo-supercharger and the second stage being driven by the engine. The gear-driven supercharger had a gear ratio of 8.0:1, and was fitted with a double-shrouded impeller with radial vanes. The Jumo 207-C was at one time in small series production, and it was rated at 1,000 horsepower at take-off and

Junkers Jumo 207-C Aircraft Diesel with Turbo-Supercharger.



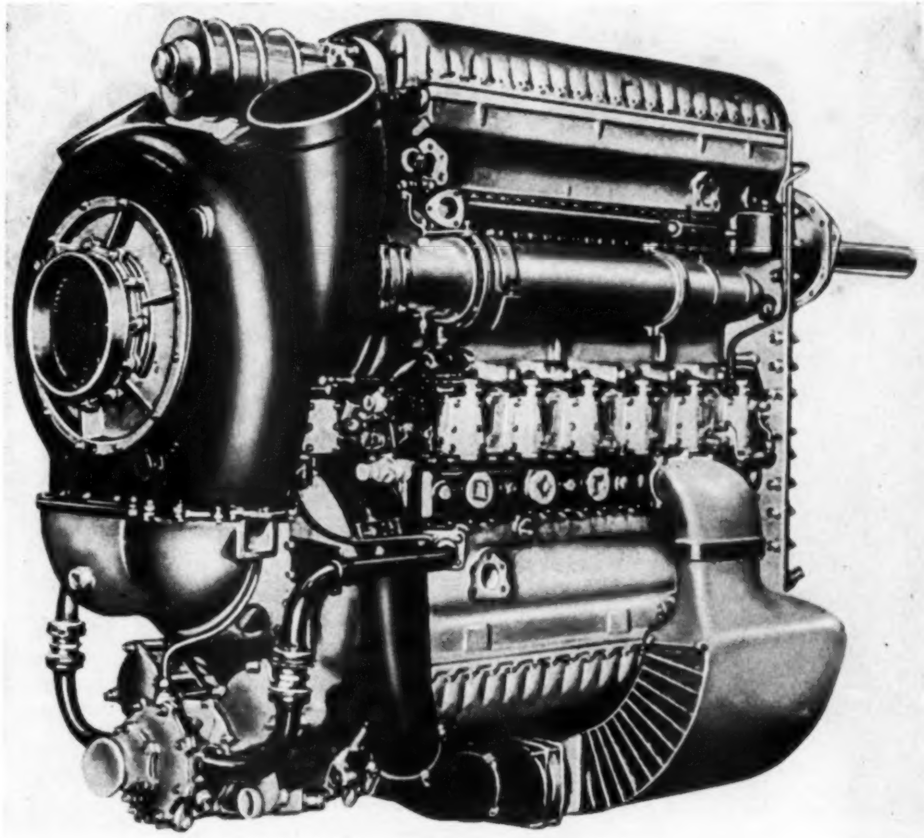
at an altitude of 32,800 feet. Its specific weight was 1.43 pounds per horsepower, and its specific output was approximately 1 horsepower per cubic inch of displacement.

The Jumbo 207-D was an offshoot of the regular Jumo 207 series. It had a slightly larger cylinder bore giving it a total displacement of 1,110 cubic inches. This increase of 8.5 per cent in volumetric displacement resulted in an increase of 20 per cent in power output, partly due to the use of an efficient intercooler. The Jumo 207-D had a maximum rating of 1,200 horsepower from sea-level to an altitude of 26,000 feet. Its specific weight of 1.21 pounds per horsepower and specific output of 1.08 horsepower per cubic inch of displacement made it a very efficient power plant.

The Jumo 206 series Diesels were considerably bigger engines with larger bore and stroke, and they had a total displacement of 1,556 cubic inches. The Jumo 206 was not equipped with a turbo-supercharger but a gear-driven supercharger maintained its take-off power to an altitude of 9,800 feet. It had a maximum output of 1,200 horsepower, with a specific weight of 1.38 pounds per horsepower and a specific output of 0.77 horsepower per cubic inch of displacement.

The Jumo 208 Diesel was a turbo-supercharged version of the Jumo 206. The addition of the exhaust-driven supercharger followed standard Junkers practice, with twin waste gates by-passing the rotor used for controlling the effective mass flow of the exhaust gases. This engine was rated at 1,500 horsepower at take-off and could maintain this output to an altitude of 26,000 feet. It had the remarkably low specific weight of 1.18 pounds per horsepower and a specific output of 0.96 horsepower per cubic inch of displacement.

The foregoing engines comprise all of the 6-cylinder in-line aircraft Diesels developed by Junkers. But there were other Junkers Diesels which never reached the production stage, such as the Jumo Double-206. This interesting power unit consists of two Jumo 206 engines mounted side-by-side with driveshafts connected to a common gear box with a single propeller shaft, similar to the system used for the German Daimler-Benz DB 606, DB 610 and DB 613 gasoline engines. This arrangement never proved to be very practical. The Jumo Double-206 was not turbo-supercharged, and it was rated at 2,400 horsepower at take-off and at an altitude of 9,800 feet. Its specific weight was 1.30 pounds per horsepower, and its specific output was 0.77 horsepower per cubic inch.



Junkers Jumo 207-D Aircraft Diesel showing Intercooler.

Little evidence has been found of the much-vaunted Jumo 223 with its 24 cylinders in square formation with four crankshafts. Only one or two models were built, and development work on this engine was abandoned in 1942. The Jumo 223, with a total displacement of 2,450 cubic inches, was designed for use with a turbo-supercharger which was expected to give it a maximum output of 2,500 horsepower from sea-level to an altitude of 26,000 feet. This would have given it a specific output of 0.83 horsepower per cubic inch of displacement.

Such were the Junkers efforts in the aircraft Diesel field. Many long distance flights over land and sea were made with these power plants proving their practicability. War-time difficulties prevented their ultimate development into power plants comparable in efficiency with the aircraft engines in use today.

JUNKERS JUMO AIRCRAFT DIESELS

Engine model (Jumo)	205-C	205-D	205-E	207-C	207-D	206	208	Double 206
Bore (in.)	4.13	4.13	4.13	4.13	4.33	5.12	5.12	5.12
Stroke (in.)	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.30
Displacement (cu.in.)	1,014	1,014	1,014	1,014	1,110	1,556	1,556	3,112
Turbo-supercharger	No	No	No	Yes	Yes	No	Yes	No
Maximum hp.	600	700	880	1,000	1,200	1,200	1,500	2,400
Maximum rpm.	2,200	2,500	3,000	3,000	3,000	2,600	3,000	2,600
Max. altitude (ft.)	8,200	8,200	8,200	32,800	26,000	9,800	26,000	9,800
Weight (lb.)	1,146	1,146	1,168	1,430	1,455	1,634	1,760	3,527
Weight (lb./hp.)	1.91	1.64	1.33	1.43	1.21	1.38	1.18	1.30
Output (hp./cu.in.)	0.59	0.69	0.87	0.99	1.08	0.77	0.96	0.77
Bmep. (lb./sq.in.)	107	109	137	131	142	117	130	117

Note: When comparing the above 2-cycle engines with 4-cycle engines, the bmep. of the 2-cycle engines should be multiplied by 2.

This Dieselized power plant at New Lisbon, Wisconsin contributes $8,000 a year to public schools.

DIESEL PLANT EARNINGS SUPPORT PUBLIC SCHOOLS . . . . .

By T. J. MALONE

SOONER or later, every well appointed and well directed, municipally owned Diesel electric plant is certain to face the enviable problem of what to do with the earnings. Those early years of payment on the investment have passed and the plant is in the clear. Operating personnel has grown more and more efficient; it has acquired know-how. Consumption shows a steady increase from year to year. Foreseeable expansion can be readily financed from revenue. Consumer rates are low enough to suit almost everybody. What to do with those earnings?

When the municipal Diesel plant in New Lisbon, Wisconsin, population 1,250, came to face this problem, it looked over the possibilities and made its decision. For the last six years, at this writing, the plant has transferred from earnings about $8,000 a year to the New Lisbon public schools. In no better way, the plant authorities thought, could the whole community profit by those earnings.

This plant has operated for the last fifteen years equipped with Diesel engines and auxiliary equipment supplied by Fairbanks, Morse & Co. For six or seven years, from 1912, a municipally owned plant, with gas-powered engine, generated the community's electricity.

Gas was made from a cheap grade of coal, in a producer. Purchased energy then replaced the city-made product for a trial of ten years or so. It gave way to Diesel.

Two Diesel engines were put in operation in February of 1931, a two-cylinder, 120 hp., and a three-cylinder, 180 hp., both Fairbanks-Morse. Early in 1938, a third engine of the same make was added, a four-cylinder, 300 hp. The rated alternator capacity of the three units, 75.4, 114.2 and 200 kilowatts, totals 389.6 kilowatts.

For the seven years beginning with 1939 these three units produced yearly more than a million kilowatt hours of energy. The high was 1,486,900 in 1940, the low 1,023,200 in 1944.

In the first eight months of 1946 output was 1,014,525 kilowatt hours. Performance of the generating equipment is indicated in the following table. The table begins with 1932 as the first full calendar year of two-engine operation, then jumps to 1939 as the first full calendar year of operation with three engines. Later years follow in order.

Year	KWH generated	KWH per gal. of fuel oil	Av. rev. per KWH gen.	Peak load, KW	Installed KW cap'y
1932	371,600	9.8	4.555c	94	189.6
1939	1,072,600	11.8	2.689	300	389.6
1940	1,486,900	12.4	2.316	390	389.6
1941	1,473,400	11.5	2.449	300	389.6
1942	1,303,000	11.6	2.694	400	389.6
1943	1,150,400	11.4	2.856	400	389.6
1944	1,023,200	11.2	2.751	360	389.6
1945	1,070,050	11.3	2.732	300	389.6
1946 (8 mo.)	1,014,525	11.4	....	...	389.6

For four consecutive years the plant's peak load exceeded its rated kilowatt capacity. This points to running overloads off and on through those years. Efforts to serve a demanding REA cooperative accounted for the overloading.

According to the plant superintendent, the four-cylinder engine, being new, was called upon to do more than its share but all units were driven hard. The plant won a release from the pressure when it cut down on serving the co-op and when a brewery, once a considerable user of energy, went out of business.

The two smaller engines, after fifteen years of responding to the call of duty, were reconditioned in May, 1946. New cylinders, new pistons, and so forth, were installed. As a result, the three-cylinder was averaging eleven kilowatt hours to a gallon of fuel oil as against ten before the replacement. Work on the two-cylinder engine had not been completed when this was written. The four-cylinder Diesel was doing 12 kwh or better.

Investment in the electric plant, as of December 31, 1945, stood at $125,055, without depreciation. This was the overall total, covering land, building, machinery, other equipment and distribution system. Book value of power house and distribution system at the time of the change to Diesel was $67,784. Deduction of that amount from the total investment leaves $57,271 as the investment in the Diesel plant including improvements to the distribution system in the Diesel period. The Diesel plant, including all additions and expansions, was fully paid for out of earnings in less than ten years of operation, without resort to tax money. Operating revenues and operating expenses by years for the seven full calendar years of three-Disel operation, with per cent of earnings based on revenues, follow:

Year	Operating revenue	Operating expense	Earnings as % of revenue
1939	$28,851.72	$12,011.18	58.3
1940	34,438.83	14,634.30	57.5
1941	36,085.37	16,591.68	54.02
1942	35,104.67	17,817.17	49.2
1943	32,861.14	19,725.32	39.9
1944	28,156.81	15,982.96	43.2
1945	29,236.63	16,784.49	42.5

The total of earnings in the seven years, $111.-188.07, was more than the $57,271 invested in the plant plus the $48,000, about, that went to the schools. Of course, interest, depreciation and other dispositions also came out of earnings through the fifteen years. What of consumer rates? After an experimental run of the Diesel plant through several months, these monthly schedules were set as of June 27, 1931:

Residential—First 15 kwh., 13.5 cents net, 14.5 cents gross; next 25 kwh., 9 cents net, 10 cents gross; excess, 3 cents net, 4 cents gross. Minimum charge, $1.00 net, $1.15 gross.

Commercial power—First 50 kwh., 8 cents net, 9 cents gross; next 150 kwh., 7.5 cents net, 8.5 cents gross; next 200 kwh., 6 cents net, 7 cents gross; excess, 3 cents net, 4 cents gross. Minimum charge of $1.00 per horsepower or fraction of connected load for first 5 hp.; 50 cents per horsepower additional.

Current schedules show quite a drop in comparison with those of 1931. They are:

Residential—Fixed charge, 60 cents net, 65 cents gross; first 50 kwh., 4.5 cents net, 5 cents gross; next 150 kwh., 3 cents net, 3.5 cents gross; excess, 2 cents net, 3 cents gross, Minimum as in 1931.

Commercial power—First 100 kwh., 5 cents net, 5.5 cents gross; excess, 3 cents net, 3.5 cents gross. Minimum as in 1931.

Commercial light—Fixed charge, first 100 kwh., 4.5 cents; next 300 at 3 cents; excess at 2 cents.

A month's bill today for a residential consumption of 60 kilowatt hours would carry a charge of $3.15 net. This is an average of 5.25 cents a kilowatt hour. A billing for that amount, 60 kilowatt hours, in 1931 was $4.58, or an average of 7.63 cents a kilowatt hour. The present charge represents a reduction, a saving, of 31.2 per cent.

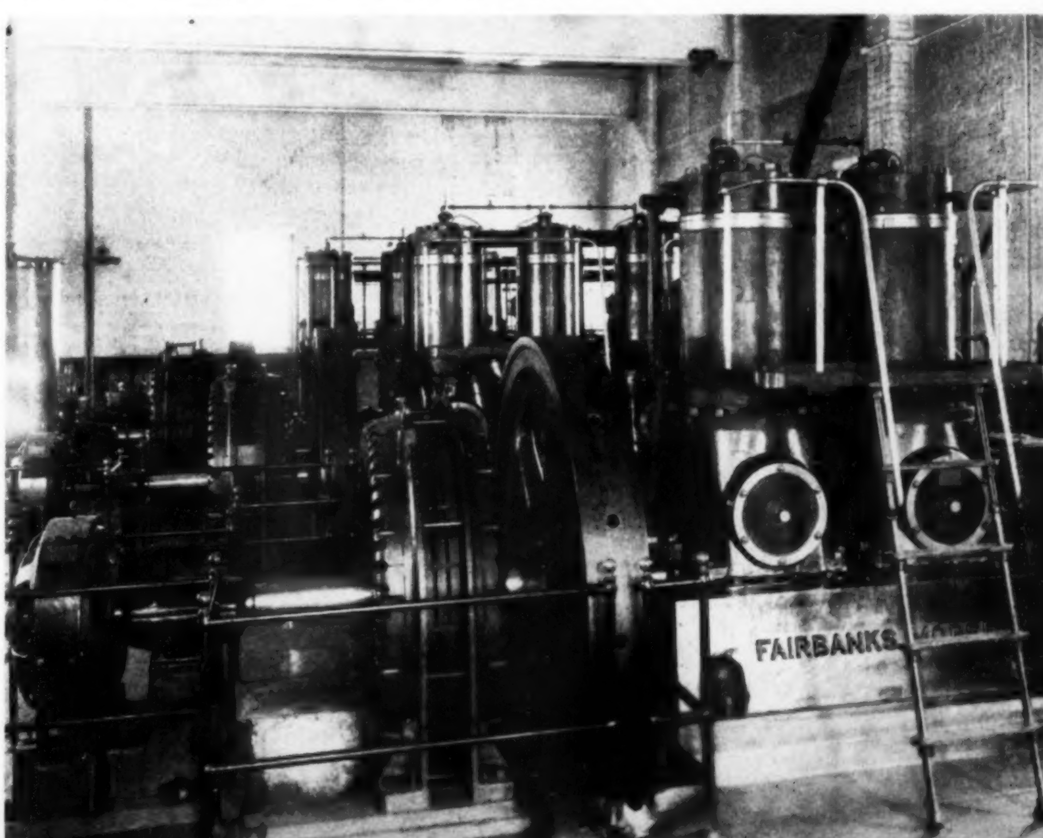
For 100 kilowatt hours consumed, a residential bill today would charge $4.35 net, or an average of 4.35 cents a kilowatt hour. On the 1931 rate, the corresponding figures would be $6.08 and 6.08 cents. This represents a reduction of 28.4 per cent.

The electric plant supplies energy without payment to a number of city services, including water pumping, street lighting, lighting of the city hall, of a city-owned conservation dam and of an outdoor war honor roll, special lighting for activities for a civic nature and powering the fire siren.

Direction of the plant is by the city council through a light and power committee. Members of the committee are C. W. McNown, Harold Oakes and Gordon Ritchart. Glenn Northcott has been superintendent for fifteen years, the full Diesel period. Peter Peterson, as city clerk, keeps the plant records. The committee also has charge of water and sewer departments.

Output for the first eight months of 1946 forecasts a record production for the full year. To serve the growing demand for energy and provide needed standby, expansion of the generating system is contemplated. When that takes place, what to do with the earnings may not be a problem.

All three of New Lisbon's Diesels are shown here. They are all of Fairbanks-Morse make.

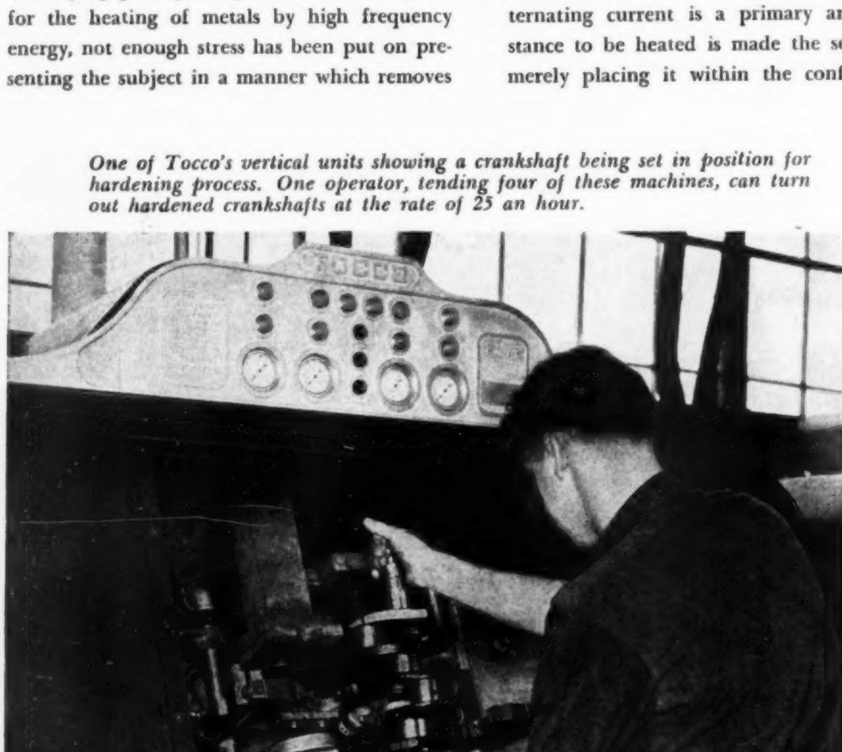


HIGH SPEED INDUCTION HEATING FOR SURFACE HARDENING

By WILL FULLERTON

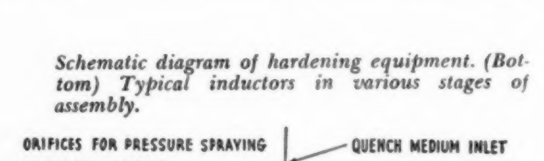
THE term "electronics" has become a commonly-used synonym for everything in the post-war electrical field. However, in the field of induction heating where the layman would suppose to find "electronics" used exclusively, one finds that high frequency currents may be produced by any of four methods. Only one of these metods, that utilizing vacuum tube oscillators, may be termed as in the electronics field. While much has been written describing the underlying principles upon which we depend for the heating of metals by high frequency energy, not enough stress has been put on presenting the subject in a manner which removes the shroud of mystery. This mystery was explained by H. B. Osborn, formerly director of research, and now sales manager of Tocco Division, Ohio Crankshaft, in a recent booklet.

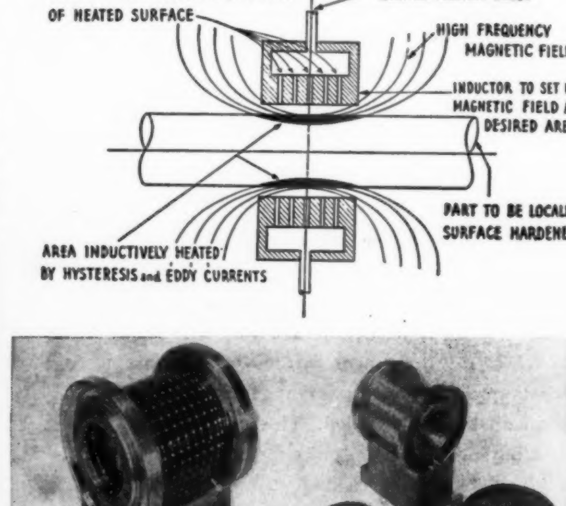
First, the only requirement that a material must have, so that it be capable of responding to induction energy and thereby become heated, is that it be an electrical conductor. An induction heating circuit is fundamentally a transformer wherein the inductor carrying the alternating current is a primary and the substance to be heated is made the secondary by merely placing it within the confines of the loop formed by the inductor, there being no contact or connection between the two. The current flowing between the inductor sets up magnetic lines of force in a circular pattern which thread through the surface of the material being heated and induce a flow of energy therein. If a magnetic material is involved it may be assumed to be made up of many small particles with individual north and south poles. These poles are reversed with the alternation of the current and thus the metal becomes heated as a result of the molecular friction of the metal particles as they tend to resist the constantly reversing current. This heating effect



One of Tocco's vertical units showing a crankshaft being set in position for hardening process. One operator, tending four of these machines, can turn out hardened crankshafts at the rate of 25 an hour.

Schematic diagram of hardening equipment. (Bottom) Typical inductors in various stages of assembly.





is termed hysteresis by electrical engineers.

The greatest source of heat is that resulting from the eddy currents which are produced in the area affected because of the intensity of the induced current much the same as the eddy swirls set up along the bank of a rapidly moving stream of water. However, since most induction heating is accomplished with high frequency (1000 cycles or above) and since hysteresis losses disappear completely at the Curie point (1420° F.), it can be said that hysteresis plays only a small part in induction heating. However, the eddy current phenomenon does play an important part in this process. Since the substance which carries the induced current is acting as a conductor it also has an electrical resistance to this flow of energy. Thus we may compare induction heating to ordinary resistance heating.

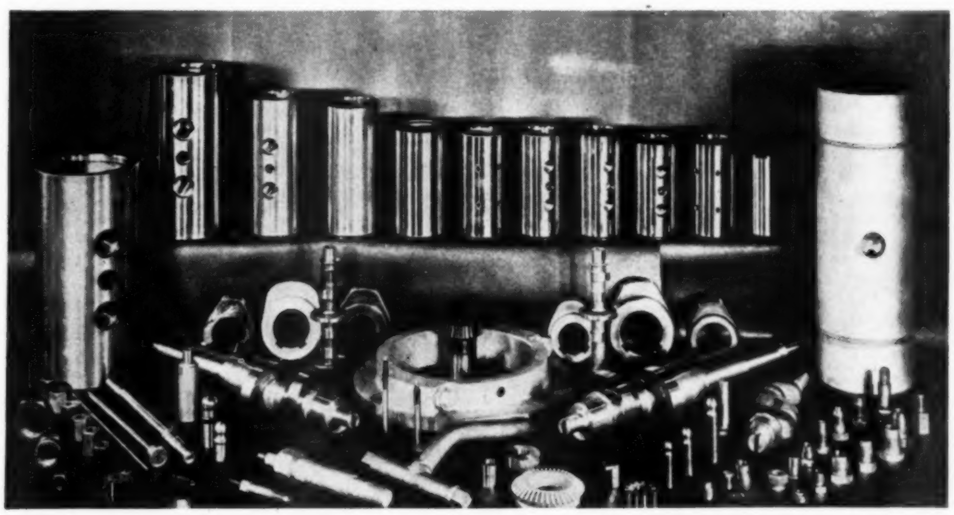
The unusual characteristic of high frequency heating upon which all surface hardening applications depend is its tendency to concentrate on the surface of the conductor through which it flows. Furthermore, the higher the frequency, the shallower will be the depth of penetration of the heated zone. Thus, the use of high power and high frequencies for a short period of time permits high surface temperatures. After the metal being treated has reached the proper temperature, it is quenched thus giving the desired hardness.

The equipment used for these operations is shown on these two pages. Current sources for this high frequency operation are motor-generators, spark gap oscillators, and vacuum tube oscillators. The motor generators provide up to 10,000 kw. at up to 10,000 cycles. The spark-gap type will provide 25 kw. at a maximum frequency of 400,000 cycles. The vacuum tube oscillators will deliver up to 500,000 cycles but are practically limited to a 50 kw. output.

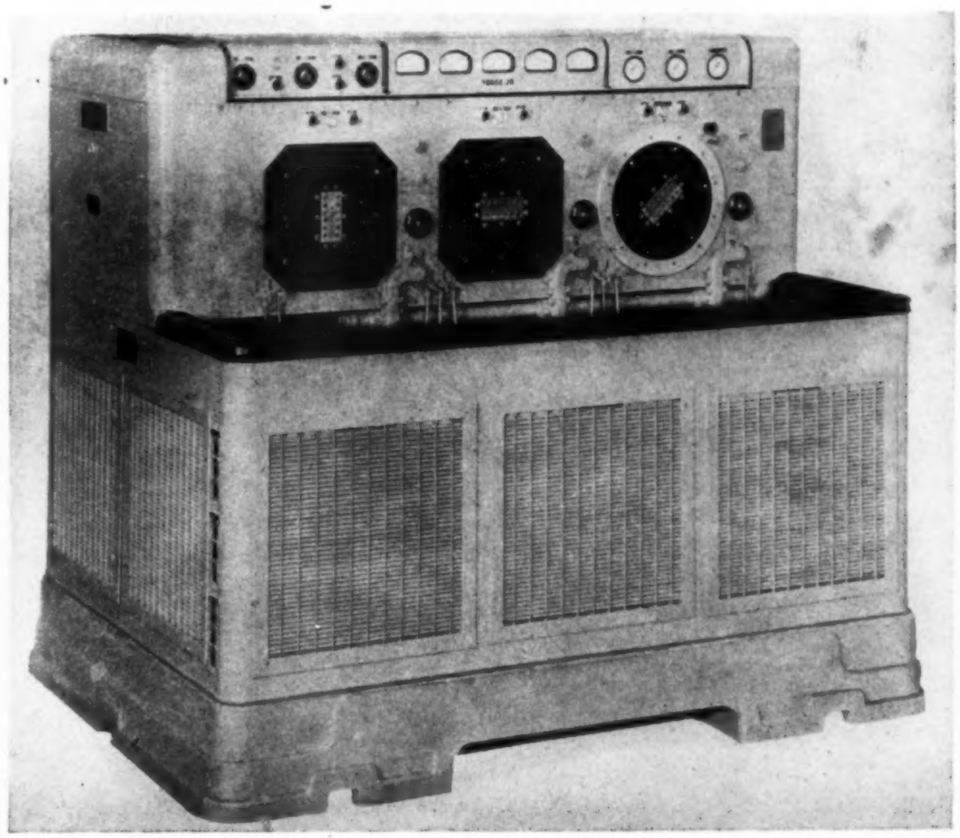
The frequencies most commonly used are of 960, 3000, 9600, and upwards of 100,000 cycles and these have been set up as the best after extensive tests.

An example of the uses of this equipment for surface hardening of engine parts is given us by the Cooper-Bessemer plant. It is claimed that that concern has saved 50% of the time formerly used in hardening Diesel parts by the use of the Tocco heating method. 105 separate parts ranging from 7/16 inches in diameter and over 18 inches long were accurately hardened to the desired degree and depth. The simplicity of the process was demonstrated by T. E. Eagan, chief metallurgist for the company, who placed a crankshaft for a Diesel fuel pump into place on the machine. By pressing a button, the selected bearing surfaces of the crankshaft became red-hot within a few seconds and jets of water automatically sprayed the heated areas, thus quenching and completing the hardening operation. By merely changing the fixture and induction coils, the machine is prepared to accommodate any one of these items which include gears, cams, wrist pins and ball races. In hardening wrist pins for example, an automatic, hydraulically operated fixture is installed which feeds the pin through the induction coils at a controlled speed so that the entire length of the wrist pin is heated to the desired temperature and quenched in one continuous operation. Hardening time for a wrist pin is 38 seconds where formerly the job was counted in hours. Furthermore this process permits the use of carbon steel in place of the high alloy steel formerly used.

Some of the many parts that are processed by a single induction heating machine at the Cooper-Bessemer plant.



Typical induction heating unit. These machines are cutting 50% from time required for previous hardening methods.



PROPERTIES OF THE DUAL FUEL ENGINE

By H. F. SHEPHERD*

THE so called Dual Fuel Engine is a normal Diesel engine which has provision for feeding gaseous fuel into the air intake and for governing the quantity of gas.

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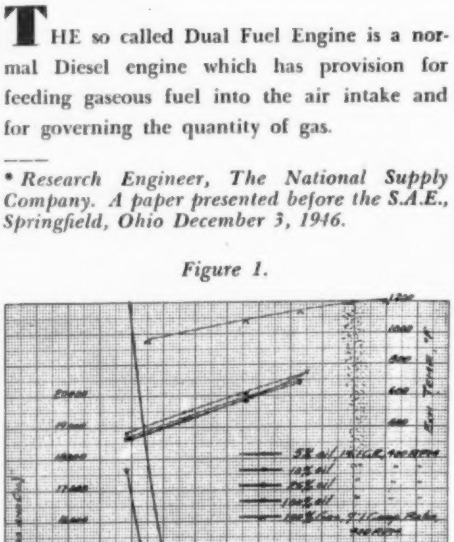
* *Research Engineer, The National Supply Company. A paper presented before the S.A.E., Springfield, Ohio December 3, 1946.*

Figure 1.



Suitable gaseous fuel such as dry natural gas has a spontaneous ignition temperature so high that Diesel compression alone will not cause ignition particularly when the mixture is as lean as is usually employed in this type of engine. The Diesel fuel injection system is used to supply small charges of fuel oil which ignite spontaneously and fire the gas-air mixture.

Early in 1945 an order was issued to our laboratory requiring us to evaluate thoroughly the characteristims of dual fuel operation in order to satisfy a commercial demand for such information.

The history of Dr. Diesel's experiments with gas and gas plus ignition oil was familiar to us through his final book and it was preserved also in the various editions of Gueldner's volume. Our Chief Engineer's files contained full information on the recent commercial development of the dual fuel engine in England. Our patent department at Toledo, Ohio contributed files. Also, travellers visiting, en route from Russia and Germany told what had been done in Europe to conserve Diesel oil during the late war by use of gas where available.

The job was not so much one of creating a new system for making power from fuel gas but rather a task of learning how and where the dual fuel engine could be utilized, what might be its economic and operating characteristics, how to control it and, not least, to establish a force of engineers to develop, design and service such engines. Few design precedents were to be found so naturally some invention was required. Four of our engineers, have applied for patents essential to the best operation of the dual fuel engine and others have contributed excellent design details.

The results of the primary tests are shown in the series of graphs Fig. 1. These show that with 5% ignition oil (5% of the full load quantity) the full load fuel economy of the dual fuel engine is superior to that of the straight Diesel. At 45 lbs. brake MEP it is no better than that of a modern Otto cycle gas engine of approximately the same size. As the quantity of ignition oil is increased the economy is bettered at all fractional loads.

Since the effect of increased ignition oil is to warm the lean charge to the point where the combustion reactions are speeded up it seemed obvious that throttling the air would affect a similar result. This was tried and proved to be true but some of the simpler advantages of

Figure 2. Gas burning Diesel showing carburetor arrangement.

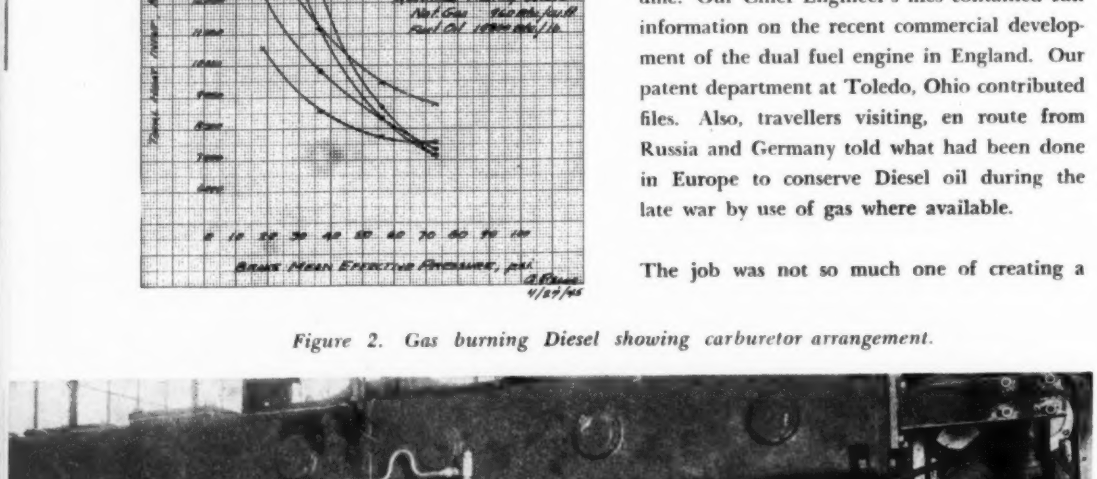


Figure 3.

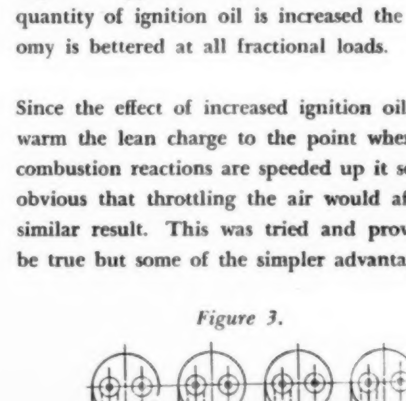
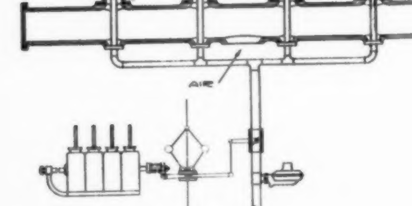


Figure 4.



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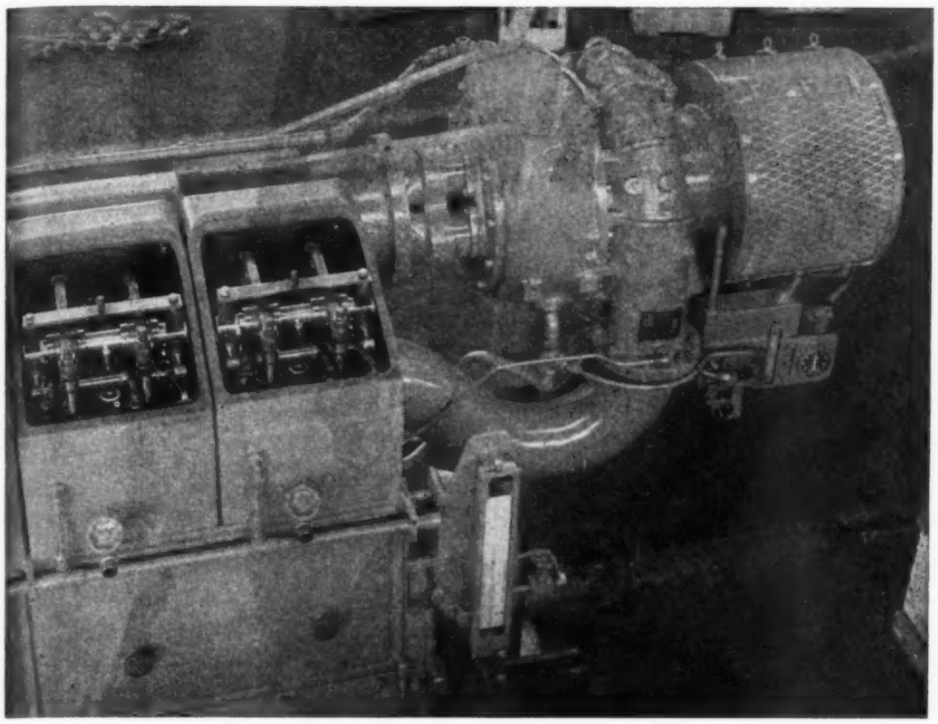


Figure 8. Turbocharger end of Superior Diesel arranged for gas operation.

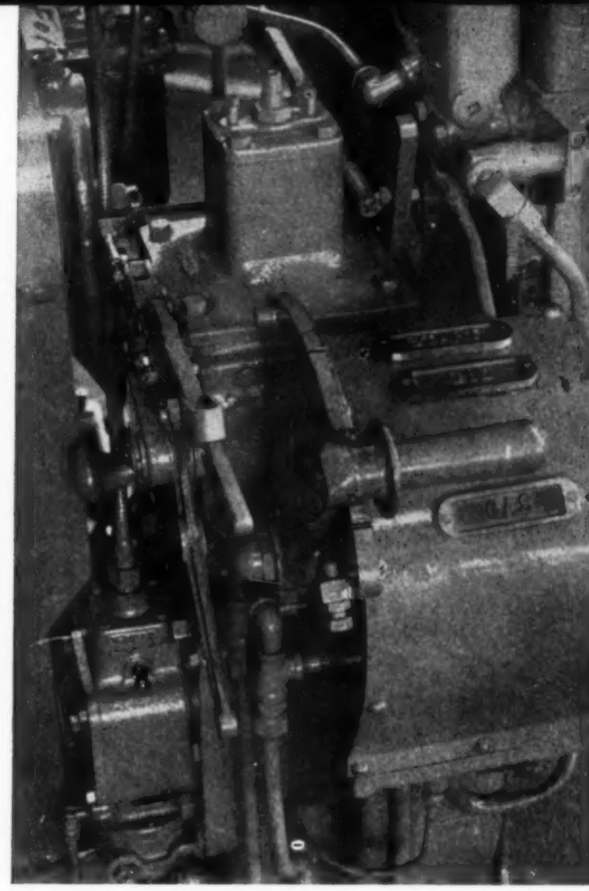


Figure 6. Control unit of Dual fuel engine.

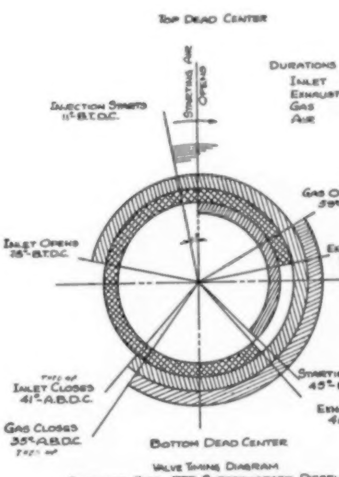
the dual fuel engine were lost. The engine became rough, particularly so on gas containing any quantity of volatiles such as are normally found in casing head gas from oil wells.

These tests might have been pursued farther to utilize the simplicity and low cost of the natural gas carbureter except for one disability of that instrument. It is designed fundamentally with a jet and venturi for producing a uniform quality of mixture at all loads. Because of the amount of ignition oil fed into each charge the proportionality is lost, the mixture becoming entirely too rich at light loads. The difficult task of constructing a variable quality - variable quantity carbureter seemed at this time to offer no reward. On simple engines for oil well drilling operations a commercial carbureter is used (Fig. 2) but, the mixture throttling butterfly is replaced by a small butterfly control valve, operating on the gas alone. Gas is introduced under low pressure and the idling jet is particularly large since the manifold vacuum falls off instead of increasing when idling at reduced speed.

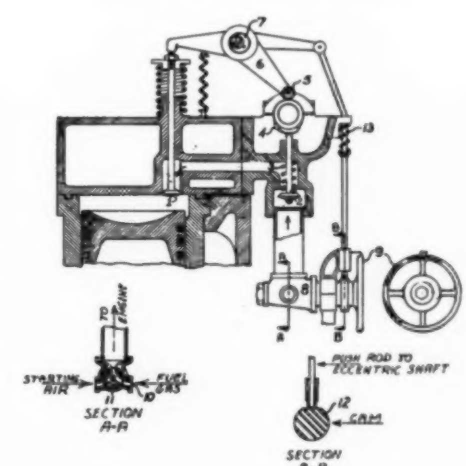
Where the best possible regulation is required it is best to eliminate the quantity of mixture contained, beyond governor control, in the inlet manifold. This is done by introducing gas through jets at each inlet valve as in Fig. 3. The Superior engine uses a special form of jet with a non return valve Fig. 4. This prevents an aspirating cylinder from sucking air into the gas pipe through the idle jets corresponding to the other cylinders. Gas distribution and consequently governing are much improved by this means.

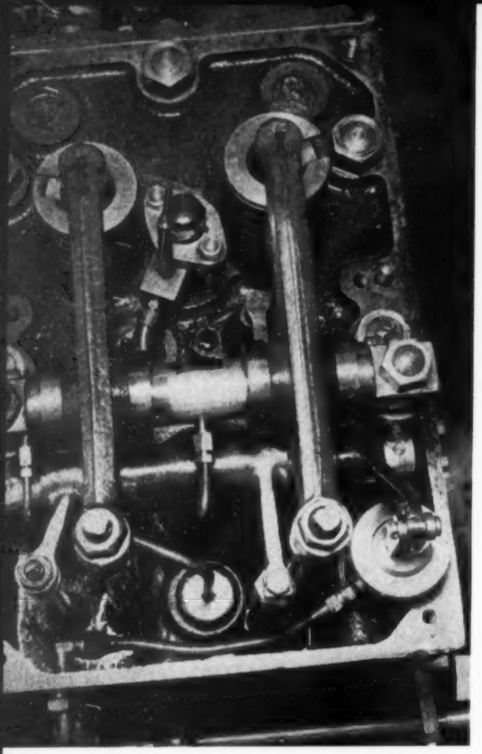
The supercharged engine requires timed admission of fuel when the Buchi system is used. The valve timing diagram Fig. 5 shows that inlet and exhaust valves are open together for 135° of crank travel about the top dead center. During this period the combustion chamber is thoroughly scavenged by a blast of air from the turbo blower. Gas may not be admitted until the exhaust valve closes. This is accomplished in the Superior engine by using the air starting system to distribute gas to the cylinders after the engine is set in operation on Diesel oil and switched to gas by means of the control unit Fig. 6.

Schematically most air starting systems contain the elements shown in Fig. 7 namely a timing valve (2) which is thrown into contact with the cam (4) when the starting air is turned on and a check valve (1) which is automatic and prevents firing back from the power cylinder into the starting air main. When using this system to distribute fuel gas the valve (2) stays out of action since the low gas pressure used cannot overcome the spring (3). The valve (1) is actuated by an auxiliary valve lever (6) set in working relation to the cam (4) by the action of the eccentric fulcrum shaft (7). The actual apparatus is shown in



(Above) Figure 5. (Below) Figure 7.





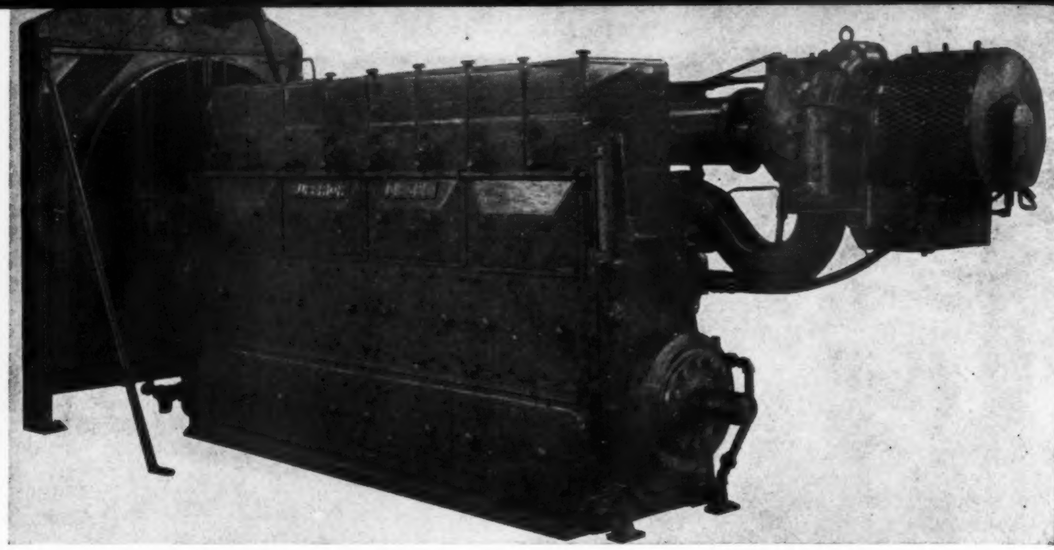


Figure 10. Superior Dual fuel engine equipped with cooling radiator.

(Left) Figure 9. View of head showing small hydraulic cylinder (near right) which controls gas admission gear.

Figure 11.

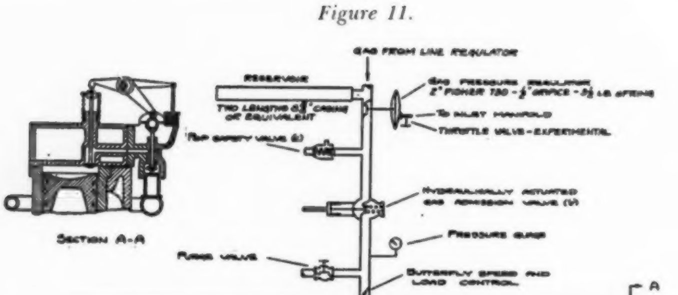
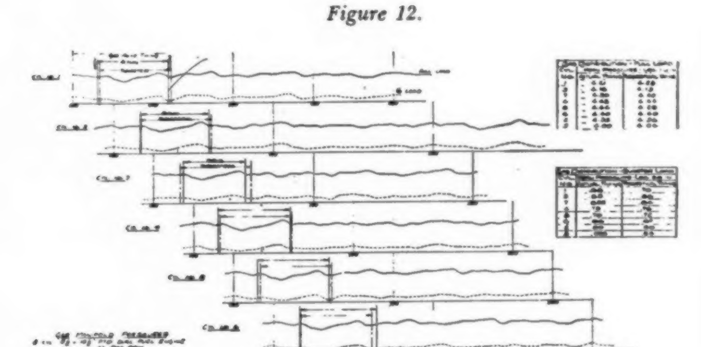


Figure 12.



place in Fig. 8. The small hydraulic cylinders shown inside the near right corners of the head covers Fig. 9 throw the gas admission gear in and out of action as the operator manipulates the control lever to the left Fig. 10. The gas-air starter piping system is shown in Fig. 11. The loop main gives remarkable distribution Fig. 12 since gas is always flowing toward a valve from one direction no matter what the firing order.

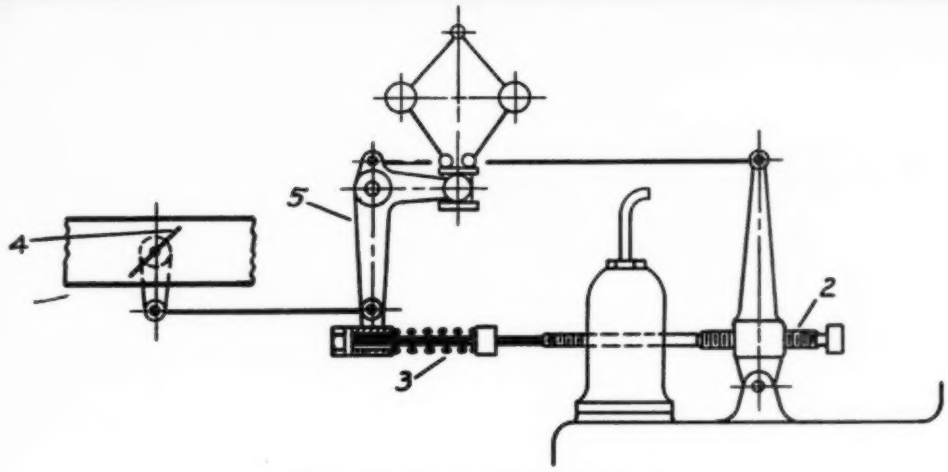
Both the maximum load capacity and the thermal efficiency are considerably greater for the supercharged dual fuel engine on gas (with ignition oil) than on straight Diesel oil. The graph Fig. 13 represents only a possible rating. It is estimated that the maximum momentary output may reach 220 BMEP and the engine actually has worked at 165 BMEP on the hoisting operations of a rotary well drilling rig. This great capacity is due to the ability to operate on gas without the great excess of air required for burning oil as injected.

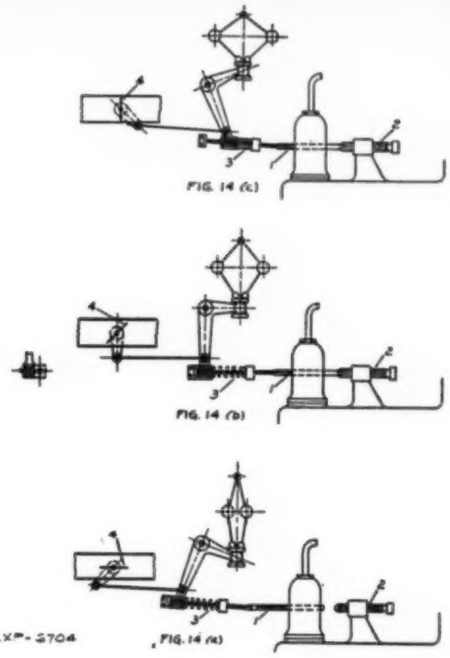
Most dual fuel engine governors move the governor lever twice as far as is required to control the engine on Diesel fuel alone. As shown schematically by Figs. 14 (a), (b) and (c) during the first half of the travel, and the only part used for full Diesel operation, the fuel pump racks (1) may be positioned for any load from 100% to friction. When gas is turned on the pump racks are located by a stop (2) so as to limit the fuel to the quantity required for ignition while further movement of the governor permitted by compression of spring (3) positions the gas control valve (4) to suit the load.

After completion of tests Fig. (1) had made it obvious that the quantity of ignition oil should be varied inversely with the load to reduce the gas consumption at fractional loads. A schematic means of effecting this is shown in Fig. 15. The stop (2) is fixed in a lever linked to the governor bell crank (5) in such a way as to push the racks slightly toward full load position as the governor moves the gas control valve (4) toward the closed position. This arrangement tends to reduce gas consumption.

While either of the above devices works satisfactorily for industrial engines with mechanical governors they are not suitable for electric generator sets since the dual range governor introduces two speed drops, the second one having a characteristic differing from the first more than it normally would due to the reaction of the spring (3). Consequently it is desired to use hydraulic governors having a speed sensitive head controlling a servo mechanism which is practically insensitive to external reactions.

The performance of the hydraulic governor, or perhaps any governor, is not the same on Diesel operation as on gas. A control movement is instantly effective on the Diesel fuel pump about to supply the charge for the next impulse. In the gas engine several cylinders are charged for the current demand and these charges will be expended before a governor control movement is fully effective. These trapped charges may be too strong or too weak for the new demand depending on whether the load is being increased or reduced. This tends to cause over-regulation, due to the rapidity





(Above) Figure 15. (Right) Figure 14.

of the speed sensitive centrifugal head and the comparative slowness of the servo system, resulting in surging.

To gain something of the Diesel governor characteristics when operating on gas the device Fig. 16 was invented. An oil filled dash pot (6) was coupled at one end to an extension of the governor bell crank (5) and at the other end to a lever pivoted on the collar (7) on the fuel pump control link. When operating on gas any sudden application of load resulting in a sudden movement of the governor bell crank in the direction to increase fuel, results in a force due to fluid friction being applied to the spring (3) compressing it and carrying the fuel pump rack also in the direction for increasing the supply of Diesel oil. As soon as control movement ceases the spring (3) centers the dash pot and it becomes ineffective under small regulatory movements. Thus momentarily the Diesel comes to the aid of the gas engine system and over regulation and surging are avoided. This gadget may be made double acting so as to operate in both directions during Diesel operations. However, it functions very well as shown since checking a surge one side of neutral is as effective as checking a full swing.

The actual device is shown in Fig. 17. The fuel pump control shaft stop (2) is fixed, the knuckle of the jack knife lever (8)-(9) strikes it when the governor motion progresses from the oil range to the gas range. The hub of the outer lever (8) is really a cam being eccentric to its pin (10). After the fuel pump control shaft is stopped by (2) further movement of the governor to control the gas causes the cam to move lever (9) away from the stop, thus increasing ignition oil as gas is decreased. The cam may be made for any range as 5% to 10% ignition oil or 7½% to 15%. Of course it must not admit more fuel than is required for idling or friction load. The oil cylinder (11) functions as (6) in Fig. 16.

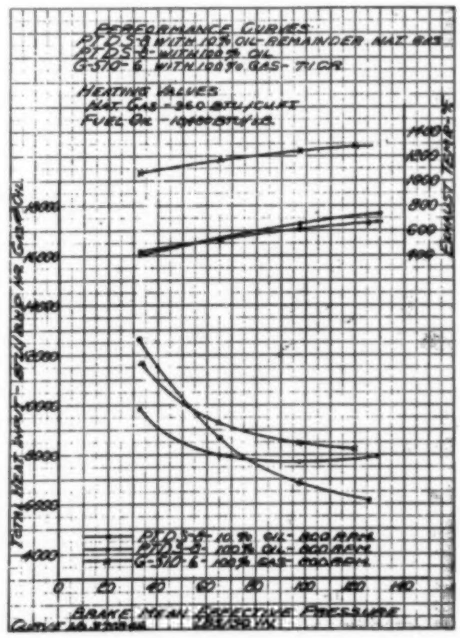
All of these developments have been manufactured or are on order. The full variety of commercial uses for the dual fuel engine is, however, yet to be determined. Present uses and proposals are:

(a) Use of utilities natural gas at lower summer rates, reverting to Diesel oil in winter.

(b) Use of Diesel fuel for drilling in new oil fields, turning to gas as soon as it is available and before a market for the gas is found.

(c) Use of gas from sewage disposal plants to operate the plant machinery as far as available, making up the deficit in fuel with Diesel oil.

(d) Use of Diesel fuel in remote and inaccessible places and substituting producer gas in case oil deliveries fail.



(Above) Figure 13. (Below) Figure 17.

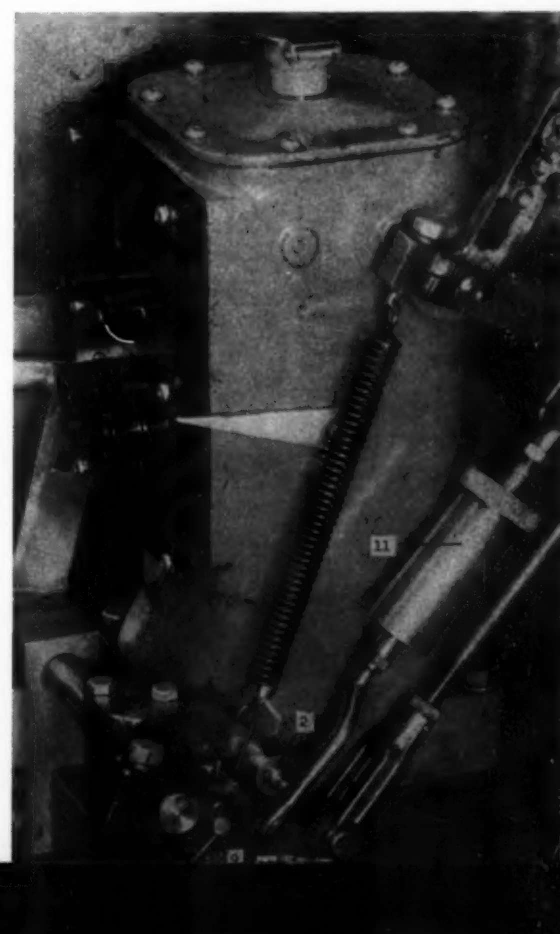
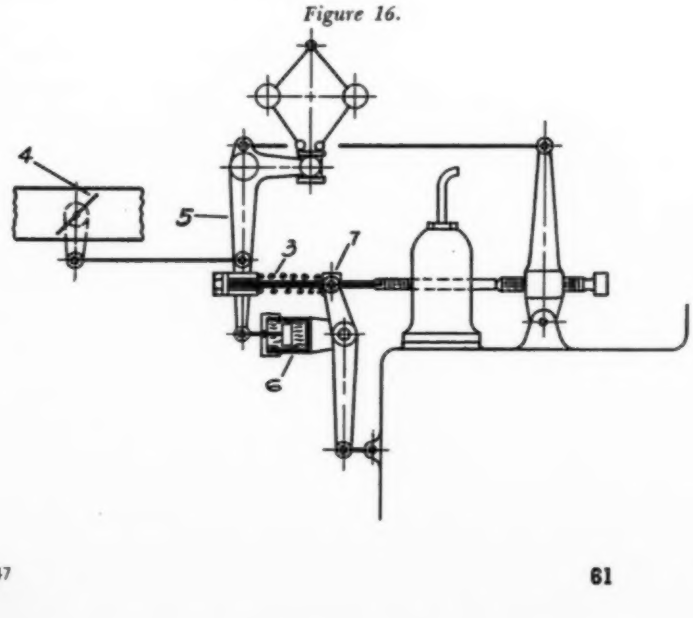


Figure 16.



TRIM DIESEL TANKER

By WILL H. FULLERTON

A TRIM tanker named the *M. S. Dynafuel,* newest addition to the Sun Oil Company fleet, completed her maiden voyage from Marcus Hook, Pa., on July 11 and settled down to the day by day job of supplying Sun's gasoline, also called Dynafuel, to the company's bulk storage terminals along the Atlantic Coast.

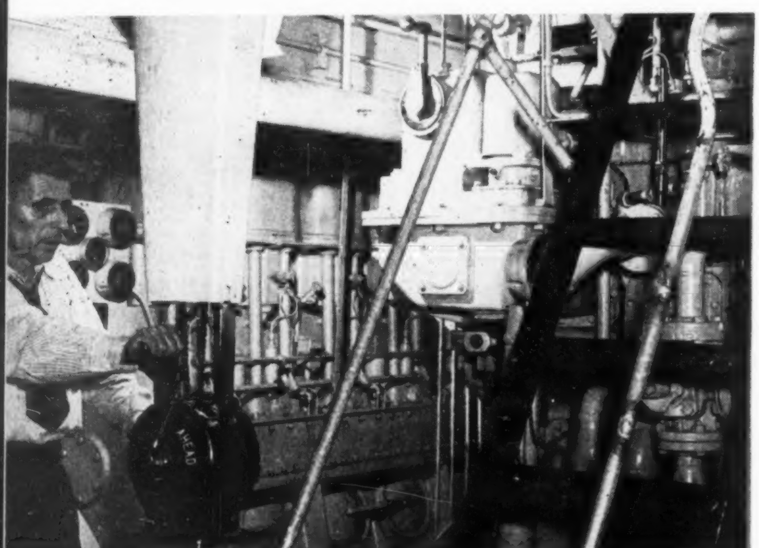
In June, when the *M. S. Dynafuel* returned from her trial runs at Jacksonville—with a broom lashed to her foremast to denote she had proved to be "sweet and clean"—the diminuative tanker had already won the affection of Capt. J. H. Hutton, assistant marine superintendent, Capt. Andrew Robinson, her master, and Chief Engineer T. E. Miller. Sun Oil marine executives were likewise impressed with the new addition to the fleet—but for performance reasons.

Designed for Navy use in the Pacific, the keel of the *Dynafuel* was laid at the St. Johns River Shipbuilding Company yards, Jacksonville, and she was launched in April, 1945. Sun Oil purchased the uncompleted ship from the Maritime Commission, and contracted with the Merrill-Stevens Dry Dock and Repair Company, also in Jacksonville, to complete the ship for commercial operation.

The *Dynafuel's* 1400 bhp. Enterprise Diesel easily turned up 12 knots during the sea trials. Anchors were surfaced in 50 seconds, and the crash test—from full speed ahead to full speed astern—was passed with honors.

Loaded draft of the *Dynafuel* is 19 ft. 4 in. (summer); length is 311.37 ft.; beam 48.32 ft.; and depth 22.84 ft. Summer deadweight tonnage is 4190. Her capacity is 30,000 barrels, gasoline, distributed among twelve cargo tanks. However, Charles L. Boyle, manager of the Sun Oil marine department at Marcus Hook, said the *Dynafuel* loaded 30.600 barrels for her first voyage.

Modern in every respect, the *Dynafuel* carries a crew of 25 officers and men, and each man has an individual room with built-in berth. Deck houses are mid-ships and aft. A large false stack contains a sick bay and electrical and storage compartments. First tanker of her type to be converted for peacetime use, the *Dynafuel's* discharge pumps can handle 3,000 barrels of cargo per hour. The piping arrangement permits the loading of three different grades of oil in lots of 10,000 barrels each, and by the use of three pumps the entire cargo can be discharged in 10 hours. The *Dynafuel,* like other ships in the Sun Oil fleet, is equipped with a CO2 fire protection system.



View of the "Dynafuel's" engine room showing Chief Engineer T. R. Miller at the controls of the 1400 bhp. Enterprise Diesel which is capable of driving the ship at a speed of 12 knots. Baldwin auxiliary Diesel is seen at left. It supplies ship's service power. Note the compact arrangement of all equipment.

Diesel tanker "Dynafuel" tied up at the Sun Oil Company Docks at Marcus Hook, Pa. She is the first BT-1 type Navy tanker converted for commercial operation. Her length is 311 feet, her beam—48 feet, with a draft of 19 ft. 4 inches. Her oil carrying capacity is 30,000 barrels.

STANDARD PRACTICES FOR DIESEL ENGINES

CHAPTER FOUR

Editor's Note: The following article is a reprint of the fourth chapter of the newly revised book "Standard Practices for Low and Medium Speed Stationary Diesel Engines" which was recently published by the Diesel Engine Manufacturers Association. Other chapters of the book will be reprinted in succeeding issues of DIESEL PROGRESS. In answer to a growing demand for the revision of the 1935 edition, this book was published. It includes the refinements, new developments and changing procedures that have marked the advances of Diesel engineering in the past ten years. The aim of this book is to be of service to Diesel engine users, prospective buyers and consulting engineers. It covers stationary Diesel engines operating at speeds up to and including 750 rpm. The book is available to readers of DIESEL PROGRESS at the price of $2.75 postpaid. Order your copy today from DIESEL PROGRESS, 2 West 45th St., New York 19, N. Y.

A DIESEL engine for constant-speed, variable-load duty, must be equipped with a governor to adjust the delivery of fuel in response to variations in load in order to maintain the speed substantially constant. Such a governor is actuated by the slight changes in speed which are brought about by change of load.

Governors may be of the relay-powered or mechanically-operating type. In any application where the engine is used for driving equipment other than generators, the less expensive mechanical or centrifugal type of governor will often suffice.

The interactions of speed, load and time required for governor operation are described by several terms which should be defined before proceeding further.

Speed Droop or Speed Regulation.—Speed droop or speed regulation is the change in sustained speed, expressed in per cent of rated full load speed, when the load is gradually changed from full rated load to zero load or vice versa, with identical settings of all parts of the governing system. This may be expressed as follows:

Speed droop or regulation in per cent equals

$$\frac{\text{(no load speed—full load rated speed)}}{\text{full load rated speed}} \times 100$$

Isochronous Governor.—An isochronous governor is one which maintains, or may be adjusted to maintain, zero speed droop or regulation.

Momentary Speed Changes.—Momentary, or transient changes of engine speed caused by sudden, as opposed to gradual, changes in load (also termed instantaneous speed changes) are expressed as the per cent increase or decrease of speed as referred to the speed at instant of load change.

Stability.—Stability in a governor is its ability to maintain speed with either constant or varying loads without hunting or periodic fluctuations.

Sensitiveness.—The per cent of speed change required to produce a corrective movement of the fuel control mechanism is called the sensitiveness of a governor.

Speed Adjustment.—Governors may be supplied with means for changing the engine speed for a given load. This may be accomplished either manually at the engine, or electrically by re-

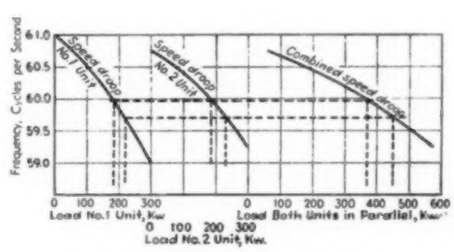


Fig. 3. Typical Speed-Droop Curves of Two Units with Similar Governors, Operating in Parallel.

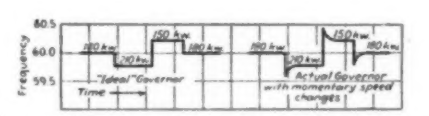


Fig. 4. Speed-Time Curves of Units with "Ideal" and Typical Governors.

mote control at the switchboard or other point. For variable speed drives, the speed adjustment may permit speeds of one-half normal or less, while for most electric drives where constant speed is required, the adjustment is only sufficient for synchronizing purposes and proper allocation of load between units. In changing speed, the governor still functions although the speed regulation usually is impaired at the lower speeds.

Over-Speed Stop.—Engines may be supplied with an over-speed stop which automatically shuts off the fuel in case the engine operates

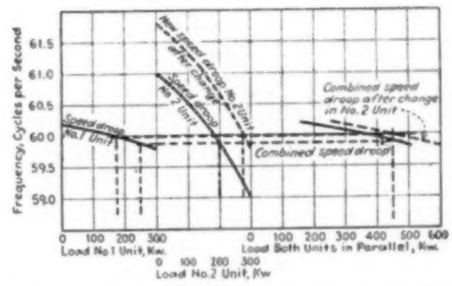


Fig. 5. Typical Speed-Droop Curves of Two Units with Dissimilar Governors, Operating in Parallel.

at a speed in excess of some predetermined value. This overspeed stop should be separate from the regular governing mechanism.

Parallel Operation of Diesel Driven Alternators.—Division of load between Diesel engine driven alternators, provided electrical resonance is not present, is purely a governing function, two separate and distinct, but simultaneous action of the governor determining the division. The first of these actions depends upon the rapidity of governor response and the second upon governor speed-droop.

The rapidity of the governor response determines the transient division for instantaneous or momentary load changes, especially when the period of load application or rejection is less than the stabilization period. If the load change continues for longer than the governor stabilization period, the load division becomes a function of speed-droop.

Operation of Speed-Droop.—As an example of the operation of speed-droop, characteristics have been assumed for two 300 kw. units as shown in Fig. 3. The illustration will apply to units of large or small size. The curve for No. 1 unit shows a speed corresponding to 61 cycles at no-load and 59 cycles at full-load, or a per cent speed droop of

$$\frac{61 - 59}{59} \times 100\% = 3.39\%$$

The No. 2 unit, by the same method, has a speed-droop of 2.52 per cent.

Considering the curve for No. 1 unit alone, it will be seen that the unit is regulated to run at 60-cycle speed when the load is 180 kw.

. . . . *And now please turn to page 72* . . . .

DIESELS MOVE INTO *CAJUN* COUNTRY

By F. HAL HIGGINS

THE flat gulf coast country from west of Houston to the sugar cane area west of New Orleans is on the list of up-and-coming American mineral and agricultural areas. Your Old Reporter has just had a week's face-to-face look at this important sector of the U. S. and believes it has a Diesel story worth telling.

After a plane flight from Beaumont to Lake Charles, he accepted the invitation of the Cummins dealer for this corner of Louisiana to ride out and see what's doing in re-powering the activities of the various lines from Transportation to Agriculture in the "Cajun" and adjacent country. So, with as early a start as the coastal fog would permit, he went out from Lake Charles with Manager R. S. Weilman of Mid-Continent Supply Company. "We'll show you at least one installation for each kind of activity," promised Weilman as we started. We drove over to Welsh, La., east of Lake Charles, and called on S. O. Scoggins, manager of Coastal Water Well Co., a young organization made up of veteran well and pump men whose know-how based on experience goes back forty years to the start of irrigation from wells in the rice farming areas here.

"I was with Lane and Bowler for 35 years," began Mr. Scoggins, "when I decided to retire and catch up on my fishing and loafing. War changed my mind, and I began looking around for the best line of pumps and power I could get for myself and associates who had decided to launch this new venture. From 35 years in the pump and well digging industries, I know who is who and why and started to get in touch with Food Machinery Corp. to get their Peerless pump line. I found they were looking for me. So it was a natural partnership. This line was new in this territory, only two or three installations being here when we started three years ago. We now have installed something near 100 Peerless pumps.

"As to power, this country is all underlaid with gas or oil, so there is a lot of natural gas used in the engines. That gives the Diesel plenty of hot competition. But the Diesel we use to meet this keen competition is the Cummins. There are some LeRoi engines burning butane, too. A pumping installation stands a rice grower around $10,000 to $12,000 by the time the well is drilled and pump and Diesel installed.

"We use V-belt, motor, flat belt and right angle gear drives. The V-belt is gaining popularity.

"We had never sold a lot of Diesels in the prewar days, though there were some old Cooper-Bessemers in the territory. They burned crude oil. Now, Diesels are coming fast because of the labor cost of attending the old pumping installations. These Cummins-Peerless installations save two men, as one man can work in his rice fields with an occasional look at his pumping engine. Probably we have 40 Diesels in this area—Buda, General Motors, etc., as well as Cummins. The natural gas vs. the Diesel is the big competition here, as gas is cheap and wasting everywhere in this area. There are some power line hook-ups of pumps, too, which adds one more competitive element. But gas and Diesel is the big competition from here on. I can recall 35 years ago when the pump power was all steam and the first fuel was wood. Then came coal, later crude oil. Look at this Cummins-Peerless installation of the Lockmoor Lumber Co., at Lake Charles, La. That firm has a lot of cut-over land. A V-belt hook-up for this 3-stage 16 in. bowl permits irrigation of 300 acres of rice."

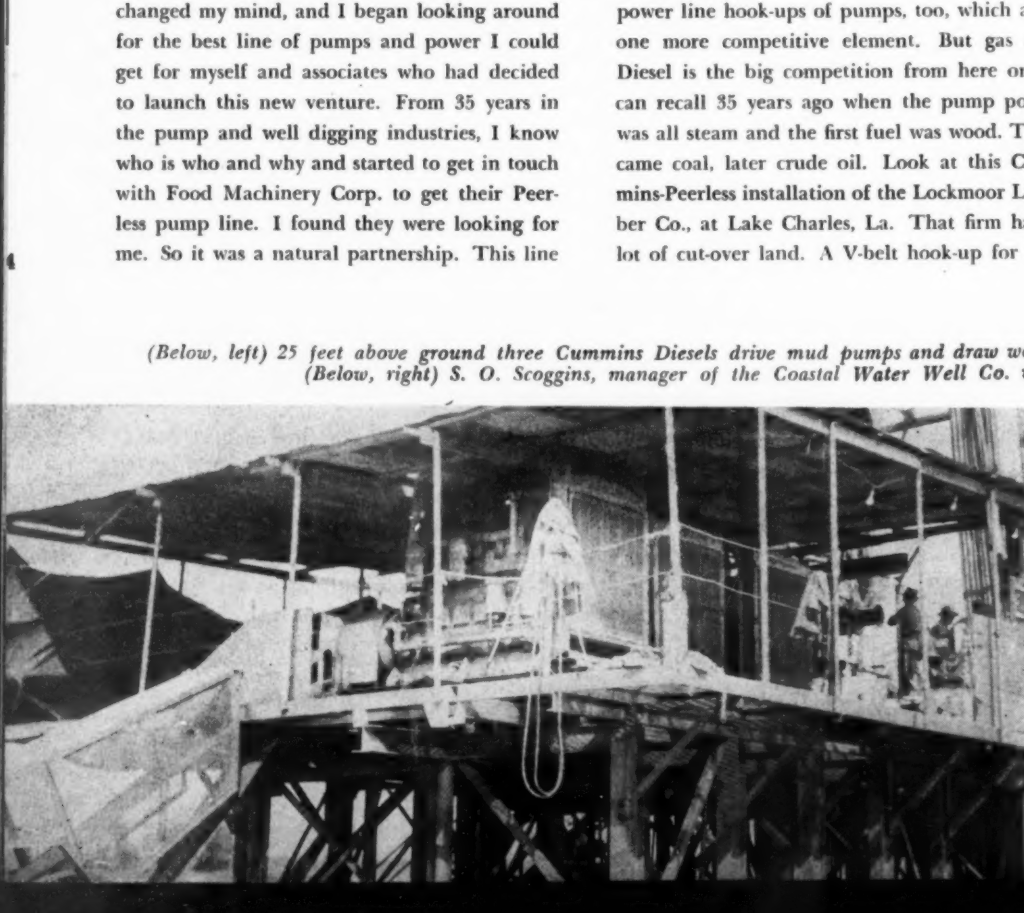
From this specialist in wells and pumps, we went on to see the Diesels over a 150-mile radius in southwest Louisiana. At the Superior Oil Co. yard, Jennings, La., we stopped to inspect an International truck with Diesel engine. This truck was getting rugged oil field service in hauling pipe and heavy oil field equipment. The outfit works over a 100-mile radius.

A. Clifton Miller, Eunice, La., has an interesting old-vs.-new Diesel pumping shed. The two Diesels—an old Fairbanks-Morse and a new Cummins HBS—sat side by side, the older one now being used only as a stand-by.

Eunice Iron Works, in the heart of this little Louisiana town, is an interesting shop that turns out about any machine shop job called for by oil field operators. Here we met Leo Heinen, manager, who was in the midst of building up a portable drill rig powered by a Cummins for water wells for the rice irrigation.

But it was at the wild cat well—semi-wildcat, observed Weilman after sizing up its location—that we really saw Diesels doing their stuff in batteries of 2's and 3's. This was on the famous Magnolia Petroleum Co., well being drilled near Marnou, La. There was the usual tall derrick with husky men in helmets busy tending drills, rods, etc., as the well went deeper and deeper towards oil. First, we inspected a pair of Cummins Diesel engines operating the mud pumps. Above, some 25 feet or more we found a trio of Cummins pulling mud pump and Wilson draw works. All five of these Diesels were Cummins.

(Below, left) 25 feet above ground three Cummins Diesels drive mud pumps and draw works at Magnolia Petroleum oil site near Marnou, La. (Below, right) S. O. Scoggins, manager of the Coastal Water Well Co. views the rich Louisiana rice fields.



LEGAL NEWS

By LEO T. PARKER*

NEW LAW SUITS AFFECTING DIESEL ENGINE INDUSTRY

LAWYERS want to win law suits involving Diesel engines and equipment even more than clients desire favorable verdicts. What chance, however, has a thoroughly good lawyer to win a suit for a client who has little knowledge of modern law and therefore does not prepare to win unavoidable suits? It is certain that our readers who read the cause and outcome of outstanding new law suits involving other Diesel equipment users will acquire legal knowledge to assist them to win future suits.

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Engines Not Taxable

It is well established law that goods, merchandise, or Diesel engines placed in "storage" in any state are taxable, by the authorities in the state in which they are stored. On the other hand, if these items move into the state in interstate commerce they are not taxable.

For example, if engines are used to "switch" freight cars used to transport merchandise from one state into another, such engines are used in "interstate commerce" and they are not taxable. The fact that the engines are removed temporarily from interstate commerce service does not authorize the state authorities to tax the owner of such engines.

In one instance, in Union Pac. R. Company v. Utah State Tax Commission, 169 Pac. (2d) 804, reported September, 1946, it was shown that the Union Pacific Railroad Company purchased eight Diesel engines—Nos. DS-1017-1020-1021-1022-1024-1030-1031 and 1032. It used them in Nebraska in the switching and hauling of interstate cars and intrastate cars. Subsequently it transferred these engines to its Salt Lake City terminal, where, again, they were used in the switching of interstate cars and intrastate cars. The engines came from Nebraska upon their own power, and before use were inspected for refueling and repairing at the railroad's roundhouse.

The Utah State Tax Commission assessed a "use" tax of 3% upon these engines based upon their purchase price. The Tax Commission contended that since the Diesel engines were in Utah a few weeks before they became engaged in the movement of interstate commerce within the state of Utah that such engines were not immune under Federal laws against Utah's state taxation. Actually in its complaint, the Utah Tax Commission stated: "In the immediate case, the assignment to use in Utah, the appropriation to use in Utah, together with the fact that the Diesel engines in question have been withdrawn from interstate switching activities in Omaha and a period of time elapses before they are further engaged in interstate switching activities in Salt Lake yards, renders the property subject to tax within the definition of the words 'storage' and 'use' contained in our Use Tax Act."

The higher court refused to agree with this contention and said:

"It is, of course, true that time elapsed between the use in Nebraska and the use in Utah; but what is the evidence of withdrawal in Nebraska from interstate activities? Merely the transfer from Nebraska to Utah—in other words, the elements of time and distance? . . . These engines were instrumentalities in interstate commerce use in Nebraska. They were transferred to Utah. Does that evidence a withdrawal in Nebraska from interstate commerce? The testimony in this case indicates that the switching of cars at all terminals is similar; and that it is impossible to segregate interstate shipping from intrastate shipping. It must be conceded, under the facts of this case, that each movement of the engines within that square from one interstate car or set of cars to another would be a movement incident to and in furtherance of interstate commerce."

On the other hand, see Henneford v. Silas Mason Company case, 300 U.S. 577, 57 S.Ct. 524.

Voters Must Approve

The importance of a new decision on public indebtedness is apparent when it is realized that sellers of Diesel equipment cannot collect the purchase price from a state, county or municipality if the indebtedness is created in violation to the state constitution. According to a late higher court decision any scheme which is a direct, indirect, or contingent obligation of a city's taxing power, will bring it within the constitutional inhibition of creating the indebtedness without the consent of the voters. For example, in Weaver v. State, 17 So. (2d) 91, it was shown that a state's constitution prohibited a public indebtedness without consent of the voters.

Certain public officials had 80% of the property owners sign a petition approving the indebtedness of $50,000 for the purpose of purchasing Diesel pumping equipment. The petition provided that the Commissioners would annually declare the amount of benefits to each property owner and levy a service charge against each for the purpose of creating a fund to retire this debt. The higher court held that the officials could not make a valid contract to purchase the equipment, unless the contract was approved by voters at a duly called election.

And again in Spearman Company v. City, 187 So. 365, the question was presented the higher court whether constitutional provisions requiring voters to approve a "public" indebtedness precluded the city from issuing time warrants against a fund created from payments of liens assessed against benefitted property owners. This higher court held that the city was without power to issue the time warrants without an approving vote as contemplated by the constitution.

Parts Interchangeable

Considerable discussion has arisen from time to time over the legal question: Can a seller who contracts to install a "specific" Diesel engine install a different but equally efficient engine, without being liable to the purchaser for breach of the contract?

For illustration, in Mathis v. Holland, 166 Pac. (2d) 518, reported April, 1946, the testimony proved that a company installed "No. 2500" instead of "No. 250" specified in the contract. The purchaser refused payment on the plea that the seller had installed a No. 2500 wholly against his will and consent. The higher court refused to hold the seller liable, and said the seller had completed his contract because No. 2500 was as good or better than No. 250 specified in the contract, and the parts are interchangeable.

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* *Attorney at Law, Cincinnati, Ohio.*

The Diesel yacht "Fairfa" at 25 knots. This 49-footer was built by the Huckins Yacht Corporation of Jacksonville, Florida.

DIESEL YACHT *FAIRFA*

By C. RAYMOND TELLER*

THIS has to do with the performance of a Diesel yacht beyond the dreams of the Diesel enthusiasts of a few years ago. Not only is she the fastest seagoing yacht in the world today but her operating cost is less than any boat of her size in history. She thus outperforms gasoline-driven craft both in speed and economy.

The *Fairfa* is the first of a fleet now in production, designed by Frank Pembroke Huckins, with the same Quadraconic Hull with which he solved the Navy's back-breaking pounding problem in the wartime PT Boat, and built by the Huckins Yacht Corporation of Jacksonville, Florida. She is 49′ 1″ long, 14′ 3¼″ breadth, drawing 3 feet at rest and considerably less underway. She starts planing at the unheard-of low speed of 8.0 knots, at 925 engine rpm, and at 1700 rpm sustains a sea speed of 22.26 knots or 25.60 mph. At full throttle, she easily outruns the open runabouts.

* Design Engineer, Huckins Yacht Corporation.

Her hull is triple, diagonal-planked mahogany, bonded with phenolic formaldhyde, hot polymerized to leakless units and fastened with everdur bronze. Nearly all structural members are laminated white oak, similarly bonded. Deck fittings and cabin fixtures are Alcoa alloy, while underwater parts are of Anaconda manganese bronze. Her accommodations, from bow to stern, consist in comfortable crews quarters for two, with adjoining shower and toilet room; a galley with gas range and automatic hot water heater and Frigidaire refrigeration; a guest toilet room with the usual Fairform electric toilet, a big deckhouse with Zenith radio and the Fairform heating plant that runs eleven hours on a gallon of Diesel oil, silently delivering 160 degree air, at 60 cfm to the various cabins; a protected flying bridge with Fairform Precision Controls, AC instrument panels and Kelvin & White spherical compass; a luxurious owner's suite. The hull is subdivided into six compartments by means of watertight bulkheads.

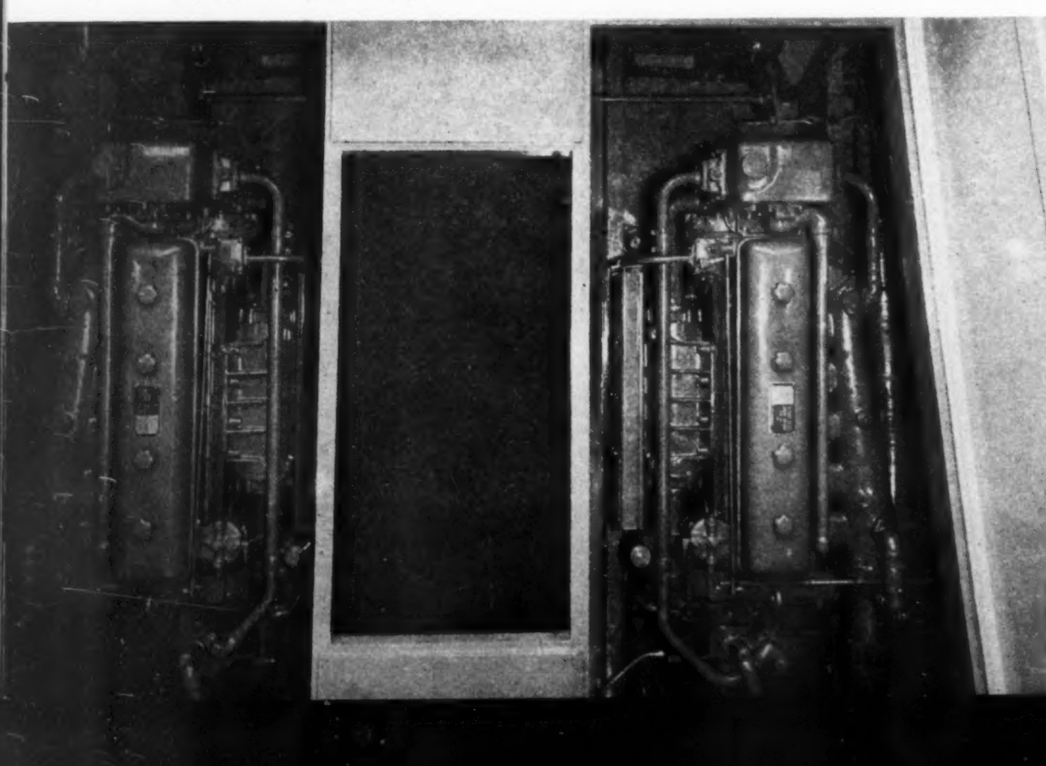
Under a large aft cockpit, sequestered in the extreme stern to hold sound level minimum in living quarters, and where access is unobstructed, is the twin-screw power plant. She is powered with the very first pair to be released of the new hydraulic reverse gear General Motors six cylinder, 200 hp. Diesels, that have already driven this yacht over 4000 nautical miles in about two months, from Florida to Maine and return. Gone is the effort of pushing big reverse levers. Instead, finger-tip controls operate the selector valve on the engine. The reverse gear is literally hidden in the flywheel, shortening the engine some 18 inches and eliminating some 350 lbs per engine, making it ideal for yacht use and producing the same boat speed, according to the designer, as gasoline engines of over 250 hp. rating.

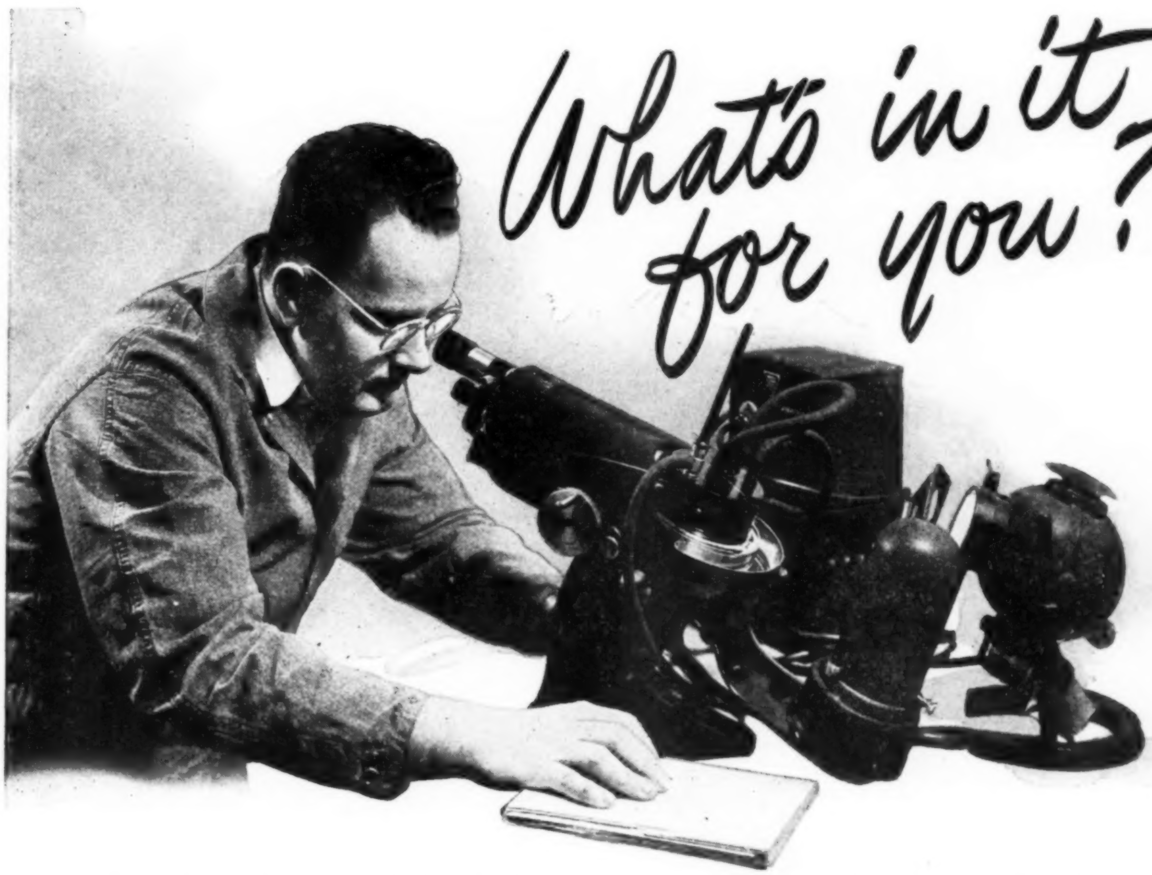
The exhaust is silenced by turning all raw cooling water into Goodrich rubber hose, without any muffler. Lord rubber units are used in the Huckins-designed mountings. Drive is by means of a jackshaft running forward, with Ajax couplings to permit slight misalignment, to the 10 degree V-drive of Huckins design and manufacture, employing Gleason spiral bevel gears, that are inaudible at all speeds. The gear boxes are goodrich mounted, with final drive through flange couplings, Monel shafts and Goodrich cutless bearings to the Michigan Equipose 24 x 24 propellers. Reduction is 1.38. Twin outboard rudders are employed, of cast manganese bronze, with the same Axe-section form as developed by Huckins for the PT boat. Steering lines are Hazard Korodless cable, with ball bearing Quarter Blocks, connected to a Kirsten Photo Electric Pilot.

For fishing, the *Fairfa* trolls at 400 rpm. In addition to the remarkably low speed at which she planes, propeller slip, at top speed, is but 9.0%; a world's record for any motor driven vessel.

Monel fuel tanks hold 300 gallons for a radius at 20 knots of over 300 nautical or about 250 Statute miles, with considerably greater range at a somewhat lower speed. At 20 knots she runs 1.04 nautical miles, or 1.20 statute miles per gallon. Lube oil constumption being negligible, her operating cost is about nine cents per mile.

View of the 2 General Motors Diesels, equipped with the new hydraulic reverse gear, which drive the twin propellers of the "Fairfa."




What's in it for you?

Conducted by R. L. GREGORY*

FUEL OIL AND BEARING FAILURE

SINCE the editors of DIESEL PROGRESS incorporated this section in their magazine, this department has received many communications from our readers. These letters vary in content: requests for information, the presentation of individual problems, and occasionally we receive one similar to the following, which presents a problem in which we feel that all of our readers may be interested.

When such a communication is received we like to pass it on, in the hopes that our readers will either receive some benefit from it, or if they have had similar experiences, will feel free to write us with their version of such a problem. With these ideas in mind, and because of the subject discussed in this particular letter being somewhat out of the ordinary, we are quoting part of a letter received from a Superintendent of a municipally owned plant. His letter in part is as follows:

"Of all the handbooks and magazine articles I have read, during the past years, I have yet to find one that makes mention of fuel oil as being a possible cause for bearing failures. Many reasons are set forth as to the cause of bearing failures, but fuel oil is not listed among them. However we have had some experiences during the war years, which have lead us to believe that fuel oil is definitely a cause for bearing failure, and I wish to give you a short outline of some of these experiences.

Any handbook on Diesel operation, discusses the importance of selecting the right fuel oil for your engine, but they seem to confine the discussion to the points of how the fuel effects combustion and the general operating condition of the engine, and also stress the point that all fuel oils having the same specific gravity and viscosity do not react the same in any particular engine. Having found out the hard way, we feel from our past experiences, that use of the wrong kind of fuel oil has been directly responsible for some of our crankpin bearing troubles, and this experience is the basis of our belief.

Prior to the war, we had been receiving all our fuel for many years by railway tank cars. But due to inability to furnish us fuel by this means, the railroads ceased shipment to us and we were forced to revert to a different solurce of fuel, said fuel being transported to our plant in truck tanks. Shortly after this change was made our troubles started.

First one unit would lose a crankpin bearing, then another and another and then possibly the first unit would lose still another. Sometimes it would be number four bearing of one unit, then number two of another, etc., but it was seldom the same bearing on the same unit. We made a complete investigation of all the causes "in the book" for such failures. We did not feel that the lubricating oil was at fault, since we had used the same lubricant year after year and all of our units are equipped with good purifiers through which the lubricant is passing continually as long as the unit is in operation, in other words we have "continuous filtration."

In replacing these bearings we used both new factory built reliners, and local machine shop relined bearings. We exercised the greatest of care and cleanliness in refitting and installing the new bearings. We tried both scraping and lapping in of the new bearings, but we still continued to lose bearings.

We finally decided to remove some of the bearings which had not up to this point given indications of trouble, and observed that these bearings showed signs of pounding and cracking of the bearing metal, yet they had not reached the point of failure. From these observations we felt that the change of fuel might have been the cause of our trouble so we decided to again make a change.

The fuel we had used because of necessity being from a different source was a much lighter fuel, the type usually used in the smaller high speed units. So when we decided to make the second change we asked for a heavier fuel and got a fuel which was slower on ignition and as I call it, a less explosive fuel, but with more lubricity. With the adoption of this heavier fuel our bearing troubles ceased and we again were back to normal operation. From this experience I feel that fuel oils can be definitely listed as "a cause for bearing failure."

The writer can frankly state that he has never experienced any such difficulty as listed in the above communication. However this department did receive a letter some weeks ago from a plant engineer, who had a similar experience in changing fuels, although his trouble had been restricted to one bearing.

We do know that the use of the proper fuel in a unit is of vital importance not only in operation but also in maintenance. These light fuel oils with more "explosive power" as this supervisor termed it, and with less lubricity are used primarily in small high speed Diesels and are not recommended for use in the heavy duty slow speed type such as used in power plants. Most Diesel manufacturers make a recommendation of the types of fuels and the range that are adaptable to their particular units and it is a pretty good policy in securing fuel oil to stay well within those recommendations.

We know the effects of highly combustible fuels on the strains and stresses of a unit, and in this particular case it is logical to assume that the strains and stresses on these bearings by the use of the different type of fuel, were in excess of those taken into consideration when the unit was designed, hence the apparent pounding out or crushing of the bearing metal.

Many of these large slow speed units are equipped with what is known as a light fuel oil tank, where a small quantity of light fuel oil is stored and which is used only when shutting down a unit which is to be idle for several days, or used in starting up after a prolonged shutdown. In this instance the fuel pump supply is changed from heavy to light fuel a few minutes before shutting down in order that the light fuel may be forced into the fuel header and lines and thus wash out the heavy fuel which might congeal in the lines during a prolonged shutdown. When the unit is again started, the light fuel oil is used until the temperatures begin to rise and the unit warms up. Then the fuel supply is switched back to the heavy fuel. This practice of using light fuel will have no serious effect on the unit as the load diminishes in shutting down.

However it is good practice not to deviate from the type of fuel as recommended by the manufacturer for his engine, since he has been all through this experimentation and knows the limitations of his engine.

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* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*


WATCH...
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MURRAY & TREGURTHA'S
HARBORMASTER

Exchange Your Diesel Maintenance Ideas

Conducted by R. L. GREGORY

Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.

Engine Maintenance Part I

IT HAS been the policy of the editors of DIESEL PROGRESS during the past few years to devote this section to our readers for an exchange of Maintenance ideas, and from the many letters we receive from our readers, a lot of good ideas have appeared in this section.

During the past few weeks however, our readers have not been sending in material as we would like to have it sent in. The writer can appreciate the cause for this sort of falling off, in as much as most plants are at present in the midst of a good plant overhauling or have most of their time occupied by the installation of new equipment and plant expansion. Therefore we are going to use this slack period to devote a few sections to a discussion of Engine Maintenance as a whole, in the hope that it will give our readers some ideas which may prove valuable in their future efforts.

As often stated in various discussions, maintenance to be properly carried out, must follow a periodical and routine inspection. How often these inspections should be made depends almost entirely on the operating schedule and the type and age of the unit in question. With a new unit, and there are many of them either being installed or on order at present, these inspections should be quite frequent. As the Maintenance department personnel become more familiar with the engine and the effect of operating schedules on the unit, they can taper off on the frequency of such inspections. This is particularly true on units that are on a year round schedule, when maintenance has to be carried on as outages can be arranged.

On engines which are operated on a seasonal basis, such as those in processing work like canneries, or units used in shipping facilities such as lake carriers, inspection and maintenance should be carried on to a great extent in the off season periods. When starting up a new unit it is well to follow the manufacturers instructions as to the first few inspections. After establishing familiarity with the unit's functions it is up to the Operating and Maintenance crews to arrange maintenance schedules as they will best fit the purpose.

Regardless of the type of unit or the service which it is rendering, it is good policy to give your units a major overhaul at least once a year. Some engineers will disagree on this point, but when one takes into account the number of hours of operation during a year, that engines in heavy duty service undergo, one realizes that a lot can take place in the way of wear and tear to a unit, especially in handling a load near its rated power.

On the other hand there is a lot of maintenance that can be carried on at intervals during that yearly period, and usually the older the unit the more of this periodical maintenance that has to be done. A great deal depends upon the type of unit, the materials from which it is constructed and the design of the unit. In the older units, made in the decade before the war, the weight per horsepower developed was considerably greater than the units made today, since the trend in design has been to lower this weight. These old pre-war engines were subjected to a lot of work and hard usage, that the present units do not undergo, which is a good thing as far as the maintenance man is concerned. They were built rugged and a lot more material was put into the unit than was actually necessary. This situation has greatly improved with modern methods of design and operation and today engineers do not believe in "piling it on" as they used to when the heavy load demands came up. Hence we can afford to have longer periods between inspections and major overhauls.

There are a few points which one should rigidly follow when a major inspection is to be made. One of the most important items is to ascertain that all parts are well marked and identified as the engine is dismantled, with accurate measurements taken of the various parts as the dismantling progresses. Many a maintenance job would have been easier and much time saved had this rule been followed. A complete record should be kept of each and every measurement so that when reassembly is in progress nothing is left to guess work. In order to keep these records as they should be kept, the maintenance crew should be well equipped with micrometers, both inside and outside, good scales and gauges, trams etc. You can not get accurate readings with poor equipment.

The next step in such an inspection and overhaul is to see that the dismantled parts are thoroughly cleaned up so that an accurate set of measurements can be obtained. Many parts of a Diesel unit have measurements down to the thousandth of an inch and if you are "miking" up a part which works on small tolerances, guess work does not count. You should be as accurate as it is humanly possible to be. Many an engineer has run into difficulty when he has guessed at a certain size, or has placed his equipment back in assembly without marking the definite location or position of the piece in question. One can not be too careful in this matter.

In removing small parts of some intricate piece of mechanism such as an atomizer, fuel pump or similar part, it is well to have marked containers and place all these parts from one intricate piece of equipment in the same container. Have containers for each piece of equipment so dismantled. We have all gone into engine rooms where a major inspection was in progress. In some such places we have seen equipment neatly stacked, in others we have seen it thrown around promiscuously with no thought or care given as to how it looks or how it will be assembled when the time comes for reassembly. The manner in which these operations are carried out, usually reflects the type of operators and maintenance men that are doing the job, as to whether they are careful and painstaking or shiftless and irresponsible.

This discussion will be continued next month.

Standard Practices

Continued from page 63

A gradual addition of 30 kw. to make the load 210 kw., will cause the speed to drop to slightly above that corresponding to 59¾ cycles. A gradual reduction in load to 160 kw. will cause an increase to a speed corresponding to slightly less than 60¼ cycles. These changes are shown in the speed-time diagrams in Fig. 4, where the increase and decrease of load are assumed to be instantaneous. The left-hand curve in this figure shows the speed-time relation for an *ideal* governor, with no time lag and no momentary fluctuation in speed other than that due to speed-droop. The right-hand curve illustrates the operation of an actual governor, with momentary speed change.

Paralleling.—Returning to Fig. 3, it will be seen that by adding the abscissae of the two speed-droop curves and plotting the sums on the corresponding ordinates, a speed droop curve can be constructed for the two units when operating in parallel. Horizontal lines drawn back from this combined curve show the load divisions for any steady load. For instance, a total of 370 kw. will be divided into 185 kw. for No. 1 unit and 185 kw. for No. 2. A total load of 450 kw. will be divided into 220 kw. for No. 1 and 230 kw. for No. 2.

Paralleling of Units with Dissimilar Speed-Droop Curves.—With the advent of relay-powered governors, it has been possible to adjust units to have very little speed-droop. An illustration of one such unit in parallel with a unit having a conventional governor is shown in Fig. 5. The No. 1 unit shown has a speed-droop of 2/3 of 1 per cent, the No. 2 unit a droop of 3.39 per cent. The combined speed-droop curve shows that the normal range of the units in parallel is from 150 kw. to 510 kw. At loads below 150 kw. the No. 2 unit will not only take all of the load but will actually motorize unit No. 1. For loads over 510 kw., No. 1 unit will be overloaded, No. 2 underloaded.

Shifting the Division of Load.—The steady load division for two or more units operating in parallel can be easily changed by changing the governor adjustment. For instance, Fig. 5 shows 450 kw. divided into 250 kw. for unit No. 1 and 200 kw. for No. 2. If the governor spring adjustment of unit No. 2 is tightened to move the speed-droop curve up to the position shown by the broken line, a new (broken) combined curve results. The division of 450 kw. is then 175 kw. for No. 1 and 275 kw. for No. 2.

. . . . And now please turn to page 74 . . . .

Standard Practices

Continued from page 72

Incidentally, an adjustment such as indicated by the broken curves has advantages for the units illustrated. It should be noted that the two units can handle 600 kw. without overload on either. It is true that 250 kw. is the minimum load, below which No. 1 unit will be motorized, but one of the units should be shut down anyway when the load falls to this low point.

When two or more units having the same governing characteristics are operating in parallel, the governors will be equally active in picking up a momentary increase of load for their respective units. Later the operation of a system containing one unit of zero, or nearly zero speed-droop will be discussed. Such a unit must have the capacity to take most of the gradual load fluctuations. It is not necessary that such a unit be large enough to take momentary load increases, because such increases are also distributed among the units with steep speed-droop curves.

Frequency Regulation.—One advantage in operating one unit of nearly flat speed-droop characteristics is the resultant close speed regulation. The broken combined speed-droop curve of Fig. 5 shows a variation in load from 42 per cent to 100 per cent, corresponding to a speed variation of 60.2 to 59.8 cycles. The unit with a steep speed-droop becomes a constant, or base, load unit, and the unit with the flat speed-droop takes the load variation. In the system represented by the broken curve of Fig. 5, the No. 1 unit, with the flat droop, has a load variation from full to no-load while the variation for the No. 2 unit is only from full to 85 per cent load. If the No. 1 unit is adjusted to zero droop, it will take all of the gradual load changes leaving the No. 2 unit to operate at a constant load corresponding to the speed equal to that of the No. 1 unit.

It is not practical to attempt to adjust more than one unit to zero speed-droop in a system of paralleling units. It would be difficult to set two such units at exactly the same frequency and still more difficult to keep them there. Even if these difficulties did not exist, the steady load division between two such units would be indeterminate.

Uniform Governing.—The preceding paragraphs have discussed regulation of units when equipped with governors of differing speed-droops. If practicable, it is generally desirable to equip

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. . . . *Continued from page 74* . . . .

all units in a plant with governors having similar speed-droop characteristics, as by so doing a change in per cent of total plant loading will be reflected in a similar change in loading of the individual units.

Nordberg and Busch-Sulzer Make a Deal

NORDBERG Manufacturing Co., Milwaukee, and Busch-Sulzer Bros.-Diesel Engine Co., of St. Louis, have announced that Nordberg has acquired certain manufacturing assets from Busch-Sulzer and proposes to continue its Diesel engine business as a division of Nordberg Manufacturing Co. Nordberg is a nationally known manufacturer of heavy machinery, including Diesel engines, and Busch-Sulzer is engaged in the production of Diesel engines.

The Busch-Sulzer Bros.-Diesel Engine Co. was founded in 1901 by Adolphus Busch and is one of the outstanding companies in its field. The Busch-Sulzer interests expressed gratification that this business is to be continued by Nordberg in view of the latter's prominence in the heavy machinery industry.

Largest Diesel Order in Rail History Placed by Union Pacific

THE Union Pacific Railroad has ordered 64 Diesel locomotives according to a recent announcement by G. F. Ashby, president of the railroad. This purchase will allow the complete Dieselization of the Union Pacific lines that lie south of Salt Lake City and will make a total of 421,500 Diesel hp. for the railroad.

The order includes two 6,000 hp. passenger locomotives from the American Locomotive Co.; five 4,500 hp. passenger locomotives from the Electro-Motive Division of General Motors; ten 6,000 hp. freight locomotives from the American Locomotive Company; eighteen 6,000 hp. freight locomotives from the Electro-Motive Division; 25 switchers from the Electro-Motive Division and four switchers from Fairbanks-Morse Co.

Sun Oil Appoints L. H. Fritz Advertising Manager

MAXMILIAN H. LEISTER, general manager of motor products sales and supervisor of advertising of Sun Oil Company, has announced the appointment of Laurens H. Fritz as industrial advertising manager.

Mr. Fritz, formerly with Aitkin-Kynett Company, Philadelphia, will take charge of advertising, sales promotion and marketing research.

Oil and Gas Power Conference To be Held at Cleveland, May 21-24

ARRANGEMENTS are rapidly being completed for the 19th Annual Conference of the Oil & Gas Power Division of the A.S.M.E., scheduled for Cleveland on May 21-24, 1947. The Hotel Statler, in that city, will serve as the Conference Headquarters.

Registration will take place the morning of opening day, Wednesday, May 21. Thereafter, Technical Sessions are planned on the following subjects: Fuel Supplies for Internal-Combustion Prime Movers (liquids, commercial gases, by-product gases); Bearings (types, features, performance); European Developments in Internal-Combustion Machinery; and Fundamentals of Combustion and Routine Use of the Pressure Indicator.

Ample time is to be allowed for plant inspection trips, in order that visitors may take full advantage of the possibilities of a city such as Cleveland, that has a wide diversity of industrial interest. The social aspects of the Conference center about the dinner, planned for Thursday, the 22nd, a number of social hours, and an informal evening get-together of the kind famous in Conference history.

Manufacturers' exhibits will play a prominent part. Advance interest in this educational feature, which has grown in scope and value of engines and related equipment will display a greater variety of items than ever before. J. M. Clark has been appointed Exhibit Secretary.

Pending announcement of final details, it is urged that those planning to attend the Conference make room reservations promptly with Hotel Statler prior to May 1, 1947.

George Codrington, prominent Cleveland industrialist and manager of the Cleveland Diesel Division of General Motors, is Honorary Chairman. Heading the overall committee on arrangements is Lee Schneitter, O & GP chairman. L. N. Rowley, Jr. is chairman of Meetings and Papers committee and C. F. Foell, Division secretary, is in charge of publicity. Locally, the committee is being assisted by P. B. Jackson, an associate of the Division's Executive Committee, and Edward Crankshaw, chairman of Cleveland Section of the A.S.M.E.

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 99.

A.S.M.E. Announces Schedule for Its 1947 Meetings

THE American Society of Mechanical Engineers meeting schedule for 1947 was announced recently from national headquarters in the Engineering Societies' Building, 29 West 39th Street, New York.

The schedule includes the sectional spring and fall get-togethers, the large semi-annual meeting in the summer, and the annual meeting in late fall, usually held in New York City. It also includes divisional meetings sponsored by some of the 19 professional divisions. A large percentage of the society's more than 22,000 members attend one or more of these meetings. They are:

Spring Meeting, Tulsa, Okla., Mayo Hotel, March 2-5.

Oil and Gas Power 19th National Conference, Cleveland, O., May 21-24.

Aviation Meeting, Los Angeles, Calif., May 26-29.

Wood Industries National Conference, Madison, Wis., June 12-13.

Semi-annual Meeting, Chicago, Ill., Stevens Hotel, June 16-19.

Applied Mechanics 13th National Conference, in June, time and place not set.

Fall Meeting, Salt Lake City, Utah, Hotel Utah, Sept. 1-4.

Industrial Instruments and Regulators Division, 2nd National Conference, Chicago, time not set.

Petroleum Mechanical Engineering Conference, Houston, Tex., Oct. 6-8.

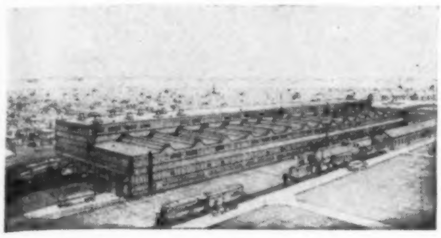
Fuels Division, joint meeting with the Coal Division of the American Institute of Mining and Metallurgical Engineers, Cincinnati, O., time not set.

Annual Meeting, New York City or Atlantic City, N. J., Dec. 2-5.

A.S.M.E. Spring Meeting

"THE Industrial Development of the Southwest" has been announced as the theme of the 1947 Spring Meeting of The American Society of Mechanical Engineers, to be held March 2-5 at the Mayo Hotel in Tulsa. Some 20 technical papers or addresses will be given at 12 technical sessions, on power, aviation, management, fuels, industrial instruments and regulators, oil and gas power, education, petroleum, and metals engineering.

Fairbanks, Morse & Co. To Erect Diesel Locomotive Plant



New Proposed Fairbanks-Morse Plant

PLANS to construct additional facilities at the Beloit Works of Fairbanks, Morse & Co. for the manufacture of railway Diesel-electric locomotives, were announced recently by C. H. Morse, III, Vice President in Charge of Manufacturing.

Erection of the new building which will be 163 feet wide and 703 feet long, has been approved by the Civilian Production Administration. The company has so designed the structure that the materials to be used will be of heavy industrial types, thus eliminating those which might conflict with the Veterans' Emergency Housing Program, Mr. Morse declared.

The building will be one story, but 54 feet in height to meet the requirements of locomotive assembly. Interior equipment will include huge electric traveling cranes and other machinery required in the construction of Diesel locomotives ranging in size from 1,000 hp. switchers to 8,000 hp. road locomotives both of which are powered by the well-known opposed piston type of Diesel engines.

"Acceptance of Fairbanks-Morse Diesel electric switchers and road locomotives has been so favorable," said Mr. Morse "that our building capacity at Beloit was soon over taxed. Hence the reason for our new construction program."

Hoke Appointed Chief Engineer For Ohio Crankshaft

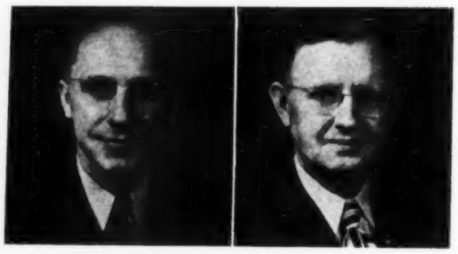
MAURICE J. HOKE has been appointed Chief Engineer of the Crankshaft and Camshaft Divisions of the Ohio Crankshaft Company, Cleveland, according to a recent announcement made by Wm. C. Dunn, President. Mr. Hoke will be in charge of all processing and development work in these divisions of the company.

A graduate of the University of Cincinnati in the class of 1939, with a Mechanical Engineering degree, Mr. Hoke came to Ohio Crankshaft in 1944 from the Consolidated Vultee Aircraft Corporation, Miami Division, where for two years he was Chief Tool Engineer.

Detroit Division Promotes Campbell and Brown

THE appointment of John C. Campbell as Manager of Industrial Engine Sales and of James W. Brown as Advertising Manager was announced recently by V. C. Genn, General Sales Manager for the Detroit Diesel Engine Division of General Motors. The appointments were made by Mr. Genn at a sales conference held recently in Detroit where plans were laid for activities during 1947.

Mr. Campbell, who will now direct industrial



J. C. Campbell *J. W. Brown*

sales of the GM Series 71 Diesel engine through Detroit Diesel's distributors and dealers, brings to his new job a wide experience in many phases of the business. He joined Detroit Diesel in 1942 as a member of the Sales Department. Since 1945, Mr. Campbell has been in charge of Advertising and Sales Promotion activities for the company.

Mr. Brown, who now takes over as Advertising Manager, has been directly connected with advertising and publication work since his graduation from Yale in 1927. He spent several years on the advertising staffs of leading publications in Cleveland, Memphis, and Dallas, and for the past year has held the position of Product News Manager for Detroit Diesel. Mr. Brown will continue to be in charge of Product News for the company.

Viking Safety Control Catalog

A NEW 30-page catalog issued by Viking Instruments, Inc., describes and illustrates the complete line of control equipment manufactured by the company for internal combustion engine applications. The equipment is offered in models designed for marine, transportation and stationary installations. These safety controls are offered in temperature-, pressure-, and speed-warning models and are automatically operative with the starting of the engine. Lights and warning signals operate automatically when temperature, pressure or speed exceed the predetermined setting. The controls are vibration- and shock-proof and those designed for outdoor or portable use are fully watertight.

The catalog is available by writing Viking Instruments Inc., East Haddam, Conn. Ask for Catalog 646.

Scherr Tool Catalog

THE new 1947 Scherr Tool Catalog has just been published by the George Scherr Company, Inc.

The new catalog is divided into groupings as follows: laboratory instruments, machine tools, machinists' tools, measuring instruments, optical equipment, and toolroom specialties. In addition, there is a section on transmission equipment and gears, couplings, chains, speed reducers, also new variable speed drives, V-belts and sheaves.

The catalog is of vast interest to the metal-working field since in addition to illustrations, specifications and descriptions of above equipment, it also devotes space to examples of the type of work that can be handled with some of these instruments and tools. Write George Scherr, Inc., 200 Lafayette Street, New York 12, N. Y., for your copy.

Link-Belt Establishes Office in Milwaukee

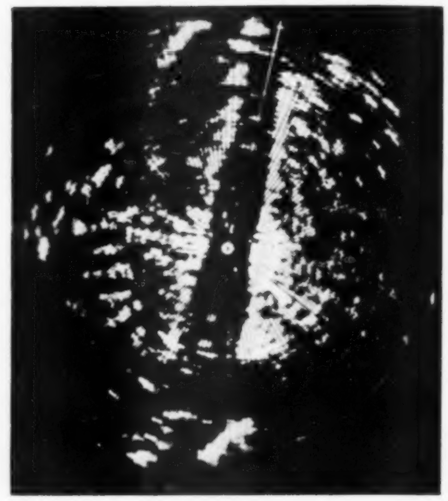
LINK-BELT Company announced recently the opening of a sales office in Milwaukee, Wisconsin, in the Century Building at 808 North Third St. William M. Hufnagel, district sales manager, is in charge of the new office, assisted by H. B. Johnson and F. E. Sweeney.

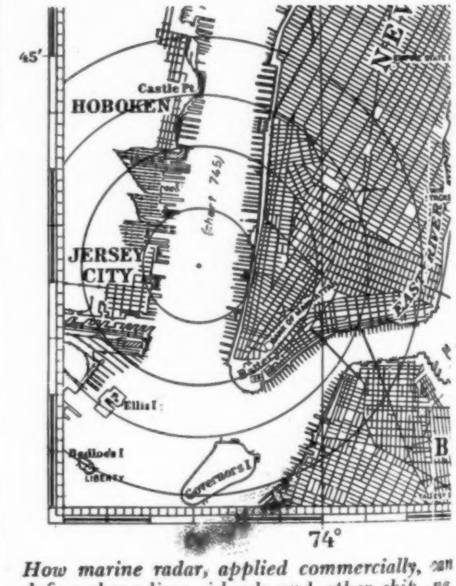
Hufnagel has been serving in the capacity of district sales engineer at Chicago, handling all company products, since 1943.

Wolverine Names Representative For Southwest United States

ACCORDING to a recent announcement by Perry Rodman, Sales Manager of the Wolverine Motor Works, The McCall Tractor and Equipment Co. of Houston, Texas has been appointed representative in the southwest territory for Wolverine Diesels. It was announced that both marine and stationary engines will be available. Contrary to the opinion which classed Wolverine Diesels as marine only, the engine has proved very practical for drag line work, deep well drilling, pumping and other stationary applications all over the world. The McCall Tractor and Equipment Company, 3714 Navigation Boulevard, Houston 1, Texas will offer Wolverine Diesels for mining and construction applications, as well as marine installations.

Marine Radar Plots New York Harbor





How marine radar, applied commercially, can define shore lines, islands and other shipping, is dramatically shown in the above radar scope photo of the lower Hudson River. The lower illustration is a chart of the area, the dot indicating ship's position.

From aboard the Sperry Gyroscope Company marine laboratory, the "Wanderer," the position of the ship and her heading upstream are clearly indicated on the scope. Sperry radar, when set to scan a two mile area, sharply defines all vessels in the river, the New York and New Jersey shores, the Battery, Governors and Bedloe's Islands.

Modern mariners are experiencing reduced hazards in open sea or inland waters as the electronic "eye" of radar points out ships, floating objects and channel markers in true relation to the ship and indicates exact ranges to these objects. Each circle on the scope and chart above equals one-half mile of range.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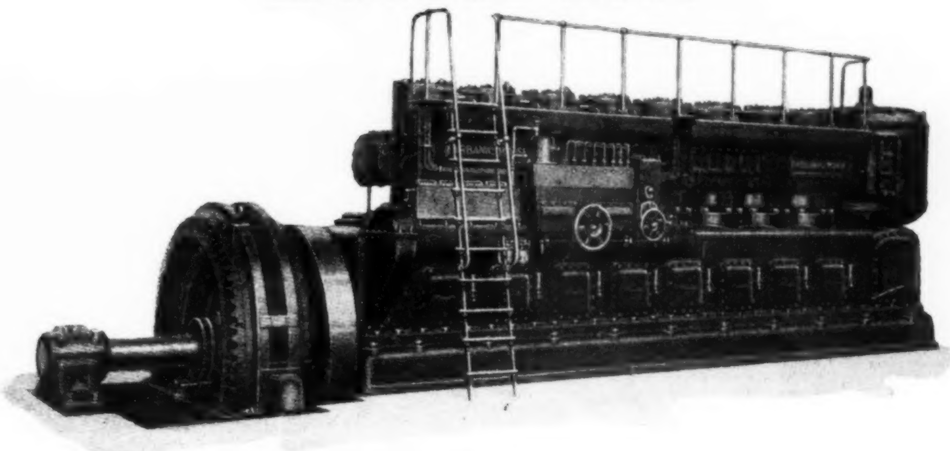


Pennsylvania Railroad Orders 25 Diesel Locomotives

THE Pennsylvania Railroad recently ordered 25 passenger and freight locomotives costing approximately $15,000,000 in a new program of Dieselization which will total over 30 million dollars when completed. In addition to the recent order the railroad is expecting delivery of 12 passenger Diesels from the Baldwin Locomotive Works and 8 passenger and 2 freight Diesels from the Electro-Motive Div. of General Motors beginning in February.

The new order will consist of 5 passenger locomotives built by the American Locomotive Co., consisting of three 2000 hp. units each; 9 passenger Diesels built by the Baldwin Locomotive works; and 6 freight and 5 passenger locomotives to be supplied by Electro-Motive. The freight locomotives will consist of five units, 1,500 hp. each. Delivery on this latest order will begin late in 1947 it was stated. The Pennsylvania will utilize these new Diesels for fast freight and passenger service between Harrisburg and Chicago.

National Marine Exposition Attracts Nationwide Interest

ROGER E. MONTGOMERY, General Manager of the Annual National Marine Expositions, recently announced that, to date, over fifty nationally prominent manufacturers and outstanding distributors from ten states have contracted for space in which to exhibit their marine products and services to the thousands of buyers and other interested persons who will throng the San Francisco Civic auditorium next May 12th to 17th when the Second Annual National Marine Exposition, sponsored by the Propeller Club of the United States, brings to the Pacific Coast its First National Marine Exposition.

Recognized as the "National Market Place of the Marine Industry" and numbered among the leading national industrial expositions of the country, the Annual National Marine Exposition will include exhibits of everything that goes into the design, construction, outfitting, operation, navigation, maintenance and repair of American ships and boats. The scope of the exhibits clearly evidences the intense national interest of the marine industry in the present and potential future value of the Pacific market.

Visitors to the Second Annual National Marine Exposition will see not only exhibits by Pacific Coast firms, but also will find there a large number of prominent eastern concerns, many of whom exhibited in New York last year.

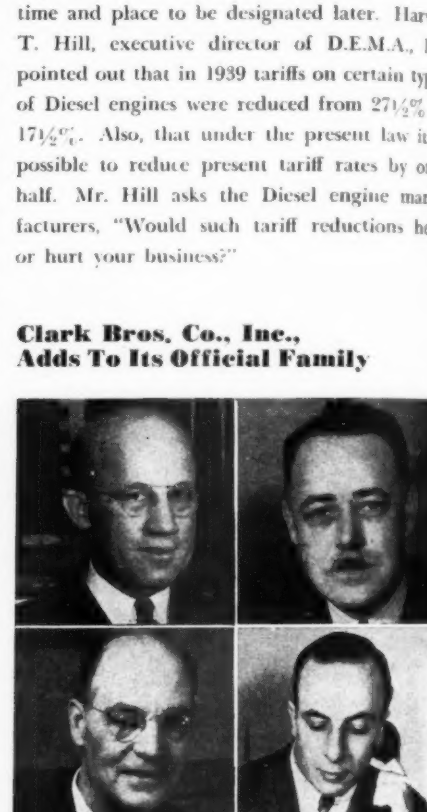
International Harvester "Young Fry" and the TD-24 Diesel Crawler

Pictured above is a group of children of International Harvester employes seated in the dozer blade of the big International TD-24 Diesel crawler tractor which will soon go into production at Melrose Park Works. The occasion was a recent "open house" held for employes of the new Melrose Park Works and their families. Over 7,000 viistors, toured the huge, new plant and saw a complete display of current and future production crawler tractors, wheel tractors, and power units. After the tour refreshments were served and the visitors saw movies of International industrial equipment in action.

DEMA Protests Tariff Reductions

THROUGH its president, E. J. S. Schwanhausser, the Diesel Engine Manufacturers Association has registered a protest with the Committee for Reciprocity Information against further reduction of tariffs on Diesel engines coming into this country, and has asked for a hearing. The Committee has consented to the appearance of D.E.M.A. representatives at a time and place to be designated later. Harvey T. Hill, executive director of D.E.M.A., has pointed out that in 1939 tariffs on certain types of Diesel engines were reduced from 27½% to 17½%. Also, that under the present law it is possible to reduce present tariff rates by one half. Mr. Hill asks the Diesel engine manufacturers, "Would such tariff reductions help or hurt your business?"

Clark Bros. Co., Inc., Adds To Its Official Family



F. H. Light — *J. N. MacKendrick*
D. K. Hutchcraft — *F. W. Laverty*

AT a recent meeting of the Board of Directors of Clark Bros. Co., Inc., the following members were added to the present roster of its official family: F. H. Light, Vice President, Treasurer and Secretary; J. N. MacKendrick, Vice President in charge of Engineering; D. K. Hutchcraft, Vice President in charge of Sales; F. W. Laverty, General Sales Manager.

F. H. Light has been with the company for 35 years, during which he has served consecutively as Purchasing Agent, Treasurer and Secretary and now as Vice President, Treasurer and Secretary.

D. K. Hutchcraft first joined the company in 1926, as a salesman, later becoming Mid Continent Sales Manager which office he held until 1945 when he became General Sales Manager and then Vice President in charge of Sales.

J. N. MacKendrick came to Clark Bros. in 1929 as Engine Designer and served in that capacity for the next seven years when he succeeded C. Paul Clark as Chief Engineer. By the recent election, he becomes Vice President in charge of Engineering.

F. W. Laverty entered Clark service in the foundry, in 1927. Thereafter, he served successively as Test and Development Engineer, Advertising Manager, Technical Service Manager, Technical Sales Manager, Assistant General Sales Manager, succeeding to General Sales Manager in the recent election.

Drico Publishes Instructive Filter Publication

THE Drico Industrial Corporation has published an instructive booklet on filtration. The information which the booklet contains has been gathered after extensive research both here and in other countries. Close contact with Vokes Ltd. of England, pioneers and foremost authorities in the field of gas and liquid filtration, assures Drico immediate information of outstanding foreign advances in the field.

A description of the Vokes principles of filtration illustrates the advantages of this system. To obtain a maximum filter surface for a given volume, the filter surface is not flat, but fin-like or corrugated, with the result that the filter area in some filters is as much as six hundred times the outlet area. When the rate of flow through the filter medium is calculated it is found that it is exceedingly low. This insures high filter efficiency and long life. It is claimed that this type filter removes particles down to 1/25,000 in. diameter.

Drico offers a complete line of air, fuel and lube oil filters. A copy of this booklet may be obtained by writing The Drico Industrial Corp., 29 Broadway, New York 6, N. Y.

Standard Oil Appoints Bedford

R. B. BEDFORD, JR. has been named assistant manager of the marine fuel oil sales department of the Standard Oil Company of New Jersey, it was announced recently. Mr. Bedford entered the employ of the company in 1930 in a sales post with the Pennsylvania Lubricating Company, an Esso affiliate. In 1940, he was named head of the company's marine shallow draft sales unit. Mr. Bedford was made a senior marketing assistant in charge of marine fuel oil sales, his most recent position, in July 1941. The company has announced that G. H. Hamilton has taken over the marketing duties formerly carried out by Mr. Bedford.

Graham Advanced By Elliott Company

Quentin Graham

QUENTIN GRAHAM was recently appointed manager of the Ridgway (Pa.) Division of the Elliott Company, according to an announcement by executive vice president, F. H. Stohr. For the past two years, Mr. Graham, as manager of the Elliott electrical engineering department, has concentrated on the design and production of several new lines of motors and generators. In his new assignment, he replaces H. S. Pahren, who moves to New York City as Elliott district manager.

New Milwaukee Hydraulic Governors

New hydraulic governor shown installed on gas engine.

THE Milwaukee Lock and Mfg. Co. now have four standard-type governors in production which utilize the principles of hydraulics and centrifugal force to produce a new type of governor. The four types now in production are the Automotive, Constant Speed, Overspeed Shutoff and Universal. The governors are adaptable to either gasoline or Diesel engines.

Detailed information regarding these new hydraulic governors may be obtained by writing the Milwaukee Lock and Mfg. Co., 730 W. Virginia St., Milwaukee 4, Wisconsin.

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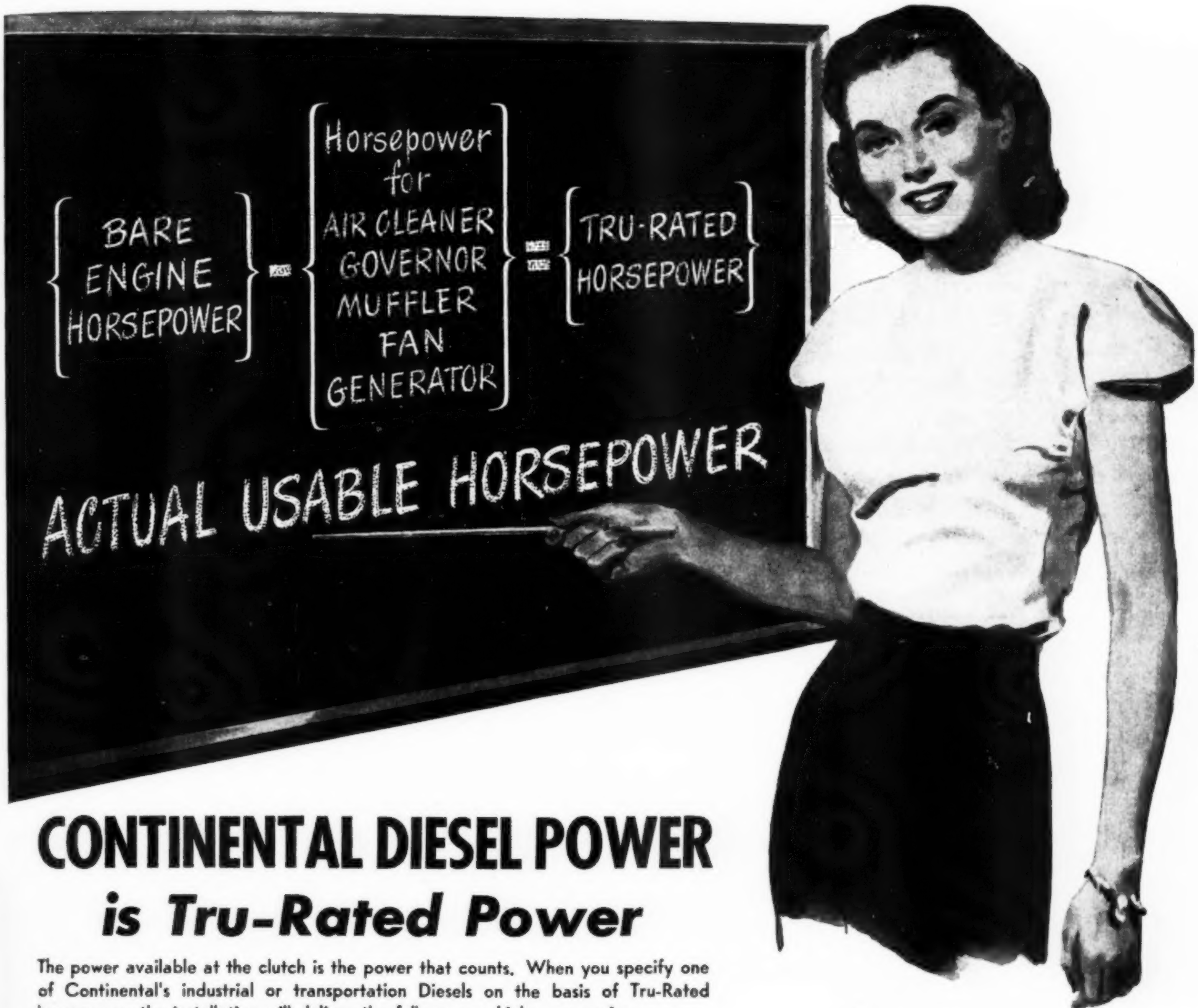

New Water Conditioning Booklet

A new 12-page instruction booklet, entitled "Allis-Chalmers Water Conditioning Chemicals and Equipment," written for the guidance of power plant operators, has been announced by the Allis-Chalmers Mfg. Co.

The booklet touches upon the importance of feedwater control, the care of testing equipment, obtaining samples, test procedures, and carries handy reference tables to assist in reporting results.

Copies of the booklet, 28X6385, can be obtained from the Allis-Chalmers Mfg. Co., 710, Milwaukee 1, Wis.

T. R. Kelley Joins the Buda Company

T. R. KELLEY recently joined the Retail Division of The Buda Company as a Field Engineer and will cover the territory embracing Northeastern section of the United States and Eastern Canada.

Mr. Kelley was President of Diesel Marine Equipment Company of Boston, N. E. distributors of Cummins engines. He closed that company in 1932 to go to Cummins factory to assist in laboratory and experimental work. From 1935 to 1941 he was Diesel Field Engineer for Waukesha Motor Company. From 1941 to 1946 Mr. Kelley was Design Engineer of Superior Engine Division of National Supply Company, Springfield, Ohio in charge of high speed and oil field engine design and development.

IF YOU HAVEN'T ORDERED YOUR COPY OF THE LATEST DIESEL ENGINE CATALOG, VOL. 11, BETTER DO IT TODAY, SEE Page 99.

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Clark Brothers Company
Consolidated Diesel Electric Corporation
Climax Engineering Company
Continental Motors Corporation
Cooper-Bessemer Corporation
Cummins Engine Company

Enterprise Engine & Foundry Company

Fairbanks, Morse & Co.
Fulton Iron Works Company

General Machinery Corp. (Hooven, Owens, Rentschler Division)
General Motors Corporation
- Cleveland Diesel Engine Division
- Detroit Diesel Engine Division
- Electro Motive Division

Gray Marine Motor Company

Hallett Manufacturing Company
Joshua Hendy Iron Works
Hercules Motor Corporation
Hill Diesel Engine Company (Division of Rogers Diesel & Aircraft Corp.)

Ingersoll Rand Company
International Harvester Company

Kahlenberg Brothers Company
Kermath Manufacturing Company

Lathrop Engine Company
Lister-Blackstone Inc.
Lorimer Diesel Engine Company

Mack Mfg. Corporation
Murphy Diesel Company

National Supply Company (Superior Engine Division)
Nordberg Manufacturing Company

Palmer Bros. Company

Rathbun-Jones Engineering Company
John Reiner Company
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Sterling Engine Company
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WEST COAST DIESEL NEWS

By FRED M. BURT

THE *Gulf Wing*, a 112-ft. Fairmile (PT) vessel, reconverted from war service for passenger service between Vancouver and Powell River, B. C., by Gulf Lines, Ltd., has been re-powered with two 320-hp. Vivian Diesels. Two 14-165 oil conditioners from Winslow Engineering Co., Oakland have been installed on the Diesels.

THE 75-ft. twin-Diesel yacht, *Chula Mia*, built by Grandy Boat Co., Seattle for C. W. Myers, Portland, Ore., is propelled by twin 200-hp. Detroit General Motors Diesels, turning the 42-in. Doran wheels. Combination Aer-O-Trol equipment handles clutch, reverse gear and throttles.

IN the fleet of hard-working tug boats operated in Los Angeles Harbor by The San Pedro Tug Boat Co., the 59½-ft. *Mary C.* and the 45½-ft. *Crowley No. 26*, each with a gross weight of 20 tons, are powered with Caterpillar Diesel V-8, 135-hp. engines.

SAN DIEGO'S disposal boats, *Harvaska*, *Reliable*, and *Rex*, have been re-powered with new Caterpillar 6-cyl. 65-hp. Diesels, sold and installed by Shepherd Diesel Marine, San Diego branch. Boats are owned by Mrs. J. R. Schdek.

SAUSALITO (Calif.) Shipbuilding Co., has four new purse seiners under construction; two 42-ft. x 12½-ft. boats will be powered (1) with a 62-hp. Fairbanks-Morse Diesel. (2) with a Caterpillar 65-hp. Diesel. The two 37-ft x 11½-ft. vessels are also powered with Caterpillar Diesels.

THE tug *Cuyamaca*, returned by the government to Ernie Judd, owner-manager Pacific

. . . . *And now please turn to page 102* . . . .

. . . . *Continued from page 100* . . . .

Towboat and Salvage Co., and operating out of Long Beach, has had her 250-hp. Fairbanks-Morse Diesel replaced with another Fairbanks-Morse Diesel of 650 hp.

THE 121-ft. $300,000 steel tuna clipper *Sunset,* built by United Concrete Pipe Corp. for the Bregante family of San Diego, has been powered with a 600-hp. Atlas Imperial Diesel, and has two smaller Atlas Diesels as auxiliaries.

THE *Jenita,* fifth in National Iron Works' series of steel clippers, will be succeeded by five more. She is propelled by a 530-hp. Atlas Imperial Diesel, and has two 112-hp. Atlas Diesel auxiliaries, each driving 92-kva generators.

BELIEVED to be the first of the tuna fleet to be equipped with radar, the big, 146½-ft. *Normandie,* after four years with the Navy, has been completely reconditioned by Lynch Shipbuilding Co., with the propulsion unit, an 800-hp. Union Diesel, and two auxiliaries, 200-hp. and 140-hp. Unions, thoroughly overhauled by George Goltz, former Union engineer.

THE 48-ft. transon stern Albacore boat, *Mahama,* built by Nunes Bros., Sausalito, Calif., is one of the finest of the boats in the 1,500 vessel Albacore fleet operating off the coast of Southern California. She is propelled by a new 230-hp. Superior Diesel.

BUILT by Sagstad Shipyards, Seattle, for Gorden Jensen, Petersburg, Alaska, the seiner-halibut combination boat *Symphony,* 56-ft. x 16-ft., is powered with a 171-hp. Buda Diesel, at 900 rpm. through 2:1 reduction driving a 50-in. x 32-in. wheel.

NEWEST addition to Sun Harbor Packing

Company's tuna clipper fleet is the *Sun Queen,* built for Manuel Drummond & Associates by Hodgson-Greene-Haldeman, Long Beach. Propelling the 123-ft. clipper at 11 knots, is a 540-hp. Fairbanks-Morse Diesel turning 360 rpm. Auxiliaries are a pair of 120-hp. Fairbanks-Morse Diesels, direct-connected to 80-kw. F-M generators.

THE Los Angeles and San Francisco officers of Nordberg Mfg. Co., Milwaukee, Wis., have been consolidated in a new building and warehouse at 647 Harrison St., San Francisco. No personnel changes were made; C. G. Cox is Pacific Coast Manager, George Lienhard, Installation and Service Engineer.

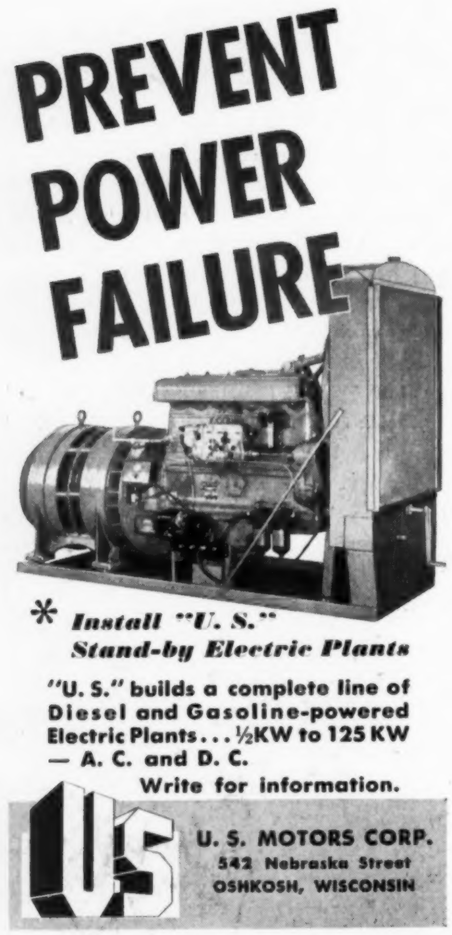
UNDER construction by the Consolidated Steel Corp., Newport Harbor, Calif. are two 126-ft. steel tuna clippers, each to be powered with a supercharged 850-hp. Atlas Imperial Diesel. Atlas Diesels will also be used as auxiliaries.

BRYNN BELYEA, President of Belyea Truck Co., and Pacific Crane & Rigging Co., died at Mayo Clinic (late November) after undergoing treatments for the past year. A heavy user of Diesel equipment in their highly diversified special and difficult moving jobs, the Belyea companies have become the largest of their kind in the U. S. Mr. Belyea was president of the Trucking Industry, Inc. and a director of Motor Truck Association.

THE Braswell Truck Co., El Paso, Texas, has just purchased six Kenworth trucks powered with 200-hp., 6-cyl. Cummins Diesel engines, from J. T. Jenkins Co., Phoenix, district sales representatives. The units were purchased as they were found to be economical even for use in states where the low (50,000 lbs.) weight limits prevail.

THIRTY Peterbilt tractors with 200-hp. Cummins Diesel engines, have been purchased by Morrison & Knudsen and Macco Construction Co., to pull 33-yd. capacity bottom dump semi-trailers, built by Southwest Welding & Mfg. Co., Alhambra, in work on the San Francisco airport extension. These form the fastest and largest earth-moving units in the far west.

CATERPILLAR Diesel units sold by Shepherd Tractor & Equip. Co., Los Angeles—25-hp. Diesel direct connected to 15-kw. self regulating G.E. generator for power and light in oil drilling operations by Miller & York, Bakersfield; a 60-hp. engine connected to a horizontal centrifugal Fairbanks-Morse pump for unwatering on a dam job in Mexico.



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